The Only Journal With a Paid Circulation in the Rock Products Industry

Rock Products

Vol. XXV, No. 2 CHICAGO January 28, 1922

POST-OFFICE ENTRY—Entered as second-class matter, July 2, 1907, at the Chicago, Ill., Post-office, under the Act of March 3, 1879.

ROCK PRODUCTS—

Geo. P. Miller, Manager
E. M. Gibson, Assistant Manager

Published every other Saturday by

TRADEPRESS PUBLISHING CORP.
542 South Dearborn Street, Chicago, Ill.

W. D. Callender, President.
N. C. Rockwood, Vice-President.
Geo. P. Miller, Treasurer.
C. O. Nelson, Secretary.

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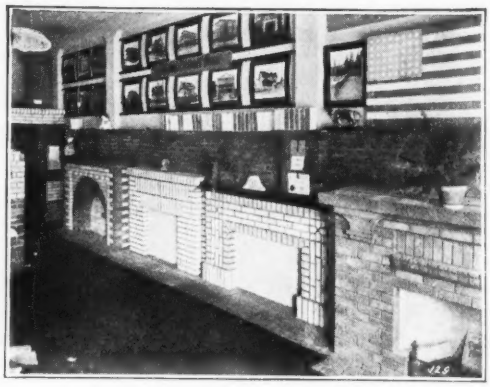
SHOPE BULLETIN

VOL. I January 28, 1922 Number 11

Concrete for Permanency

A permanent business, one that places you in the Packard class. Have you noticed other concrete brick machinery advertised? All they talk about is their machines. Wonder why they do not feature buildings, and use of their product? It's the product you will want to sell and are most interested in. With basic patents a monopoly eliminating ruinous competition, giving you the opportunity to keep the standard A1 and service that will protect your investment.



Display of Shope Brick—Salesroom of Shope Brick Co., Portland, Oregon

Are you from Missouri? Write for consignment of the "Show-Me."

We honestly believe we have the best brick proposition on earth in most localities where concrete aggregates are available, considering every angle of efficiency in production and wide range of color schemes and finishes.

All guaranteed under every known test of building codes, water proof, fire proof, permanency of color and originality and ornamentation.

Hasten your inquiry—or your territory may be grabbed off
Write for complete information

Shope Brick Company

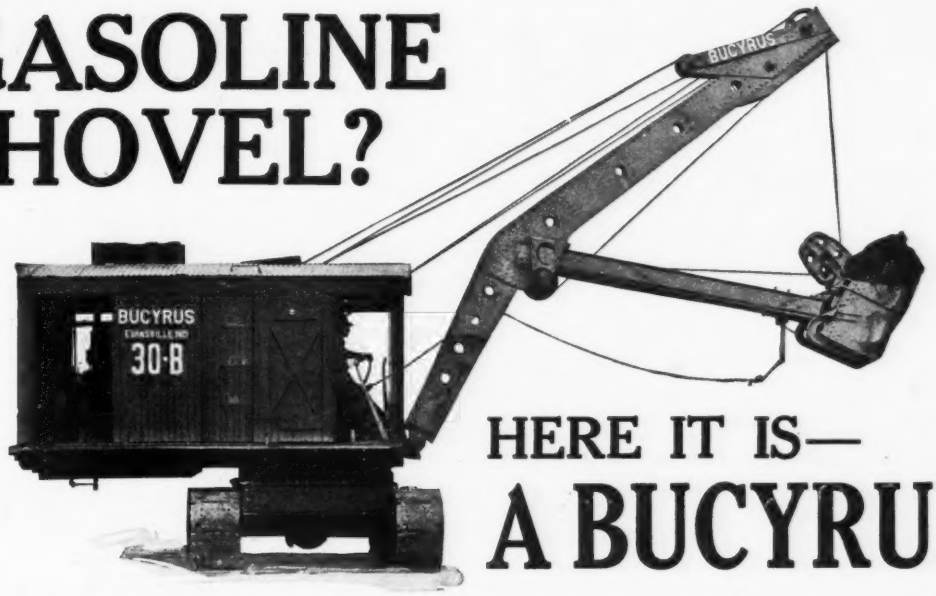
361 East Morrison Street Portland, Oregon

LICENSEES:

The Miles Co.	Salem, Ore.
Eugene Concrete Co.	Eugene, Ore.
Wastenburg Brick Co.	Klamath Falls, Ore
Arizona Shope Concrete Brick Co.	Phoenix, Ariz.
Florida Nu-Tex Brick Co.	109 Water St., Tampa, Fla.
Texas Shope Brick Co.	3056 Sumpter Bldg., Dallas, Tex.
Birmingham Slag Co.	Birmingham, Ala.
Shope Brick Co. of Wisconsin	50th and State Sts., Milwaukee, Wis.
The Polychrome Cement Brick & Tile Co.	Carter-Cotton Bldg., Vancouver, B. C.
Dark Canyon Stone Co., H. W. Jones, Mgr.,	Rapid City, S. D.
Warren Sand & Gravel Co.	Easton, Pa.
Penn Shope Brick Co.	Reading, Pa.
Lycoming Shope Brick Co.	Williamsport, Pa.
Shope Brick Co.	Portland, Ore.
Rustic Brick & Supply Co., Palette Rd.,	Ford City, Ont., Can.
Puyallup Shope Brick Co.	Puyallup, Wash.
The Shope Brick Co.	Springfield, Mass.
Utah Shope Brick Co., P. O. Box 632,	Salt Lake City, Utah
Decoration Brick Co.	1565 N. Lake Ave., Seattle, Wash.

These licensees are all successful manufacturers

ARE YOU INTERESTED IN A GASOLINE SHOVEL?



HERE IT IS— A BUCYRUS

A 1-Yd. shovel operated by a single, rugged, slow speed gasoline engine.

A positive, powerful thrust with no engines, motors, chains, belts, gears, clutches or complicated shafting on boom.

Digging power actually greater than a steam shovel of same size.

Same digging characteristics as a steam shovel—for instance, you can shake the dipper to relieve it of sticky material.

Greater tractive power than a steam shovel of same size.

Far simpler in design and easier to maintain than any other type of gasoline or gasoline-electric shovel.

The Bucyrus 30-B gasoline shovel will handle 20% more material per gallon of gasoline than any other type of shovel whose power is obtained from a gasoline engine.

Convertible for work as a dragline excavator, clamshell excavator or crane.

It Will Pay You to Investigate

Bucyrus Company

South Milwaukee, Wisconsin

BRANCH OFFICES:

Birmingham	Salt Lake City	San Francisco
Minneapolis	New York	Denver
	Chicago	London, England
	Portland, Ore.	

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Cut Out and Mail This Coupon

BUCYRUS COMPANY
South Milwaukee, Wisconsin

Please send me your bulletin F-301-P, describing your new 30-B gasoline shovel.

My work is.....

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Signed.....

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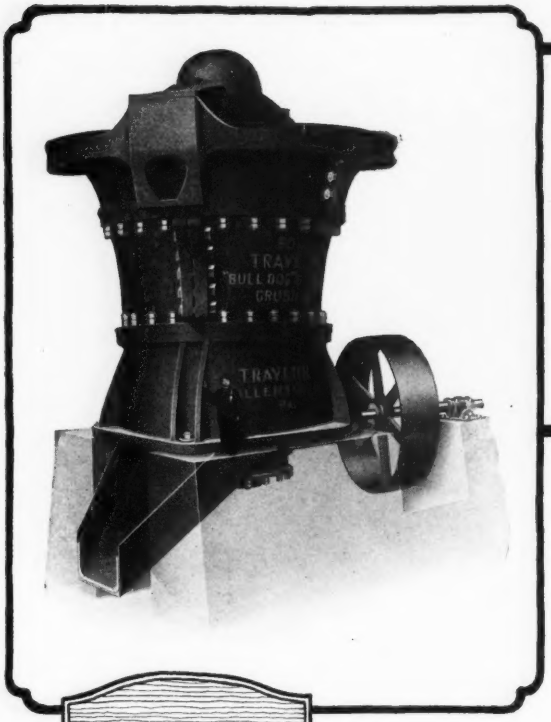
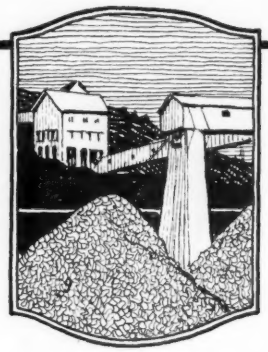




The Success of Your Plant Depends on the CRUSHER-

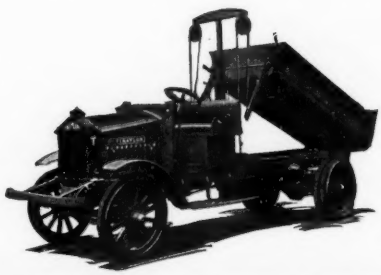
The simplicity, strength and reliability, the economy and staying qualities of the Traylor "Bulldog" Crushers, is due to the exclusive "Bulldog" features.

The Bend-Proof Shaft—the Hewes Spider—the cut steel gears that run in oil—the perfect Force Feed lubricating system and the self-aligning eccentric journal—all mean a greater output for less power per ton.

Bulletin RGX-1 tells why Bulldog Gyratories increase production. Get it today.

TRAYLOR TRUCKS

This truck is already conspicuous by reason of its remarkable performance in the Rock Products field. It is a truck of rare economy in operation and its staying qualities bring renewed satisfaction to owners each day.



Traylor Engineering & Manufacturing Co.

Main Offices and Plant: ALLENTOWN, PA.

New York, 30 Church Street — Pittsburgh, 211 Fulton Bldg. — Chicago, 1414 Fisher Bldg.

Los Angeles, Citizens Bank Bldg. — Spokane, 616 Mohawk Bldg.

Truck and Tractor Division: Cornwells, Bucks Co., Pa.

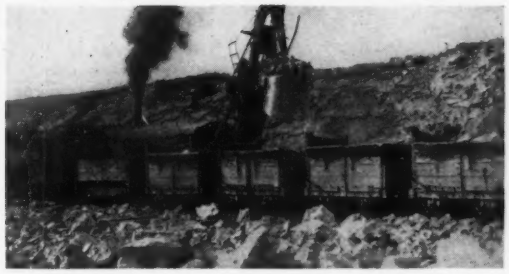
Southern Office: Austin Machinery Corp. of La., Inc. 1215 New Hibernia Bank Bldg. New Orleans, La.

Southeastern Office: C. B. Davis Engineering Co. Brown-Marx Building Birmingham, Ala.

Limestone Cliff

The Shot

250,000 Tons of Broken Stone



Loading Out the Stone After the Shot

Pictures of a limestone quarry in Illinois. 57,000 lbs. of General 40% L F Gelatin were used in this blast. This figures approximately 4 1-3 tons of stone per pound of powder.

QUALITY SERVICE

GENERAL EXPLOSIVES COMPANY
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U.S.A.

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Atwood, Tenn.

Rock Products

Volume XXV | Chicago, January 28, 1922 | Number 2

Jahncke Service's Operations in New Orleans

One of Leading Producers and Dealers of Building Materials in South

EVEN the casual visitor to New Orleans would be impressed by the importance of the sand, gravel and crushed stone industry, because right alongside of the Union Station, into which all trains enter New Orleans, is situated the wharves and yards of the Jahncke Service, one of the largest producers and dealers of building materials in the South. The wharves are on the Basin Canal and the bulk of the material is brought down to the wharves on barges, which are towed by steamers. The old Basin Canal is one of the most picturesque spots in quaint old New Orleans.

General view of wharves and yards of the Jahncke Service, New Orleans, La.

History of the Organization

The Jahncke Service was organized in the year 1870 by Fritz Jahncke, who first came to New Orleans as a contractor and who was forced into the building material industry by necessity. At that time it was very difficult to obtain materials, and as it was a case of the "survival of the fittest," he started to produce the materials himself. From that humble start the company has so developed until today it is one of the leading concerns of the South, operating four sand and gravel plants, an oyster-shell crushing plant, concrete block plant, an enormous building materials business and a dry-dock and ship building company known as the Jahncke Dry Dock and Ship Repair Corp.

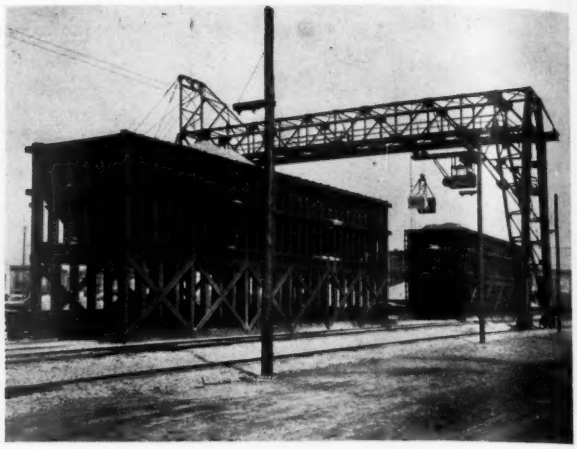
Fritz Jahncke was a pioneer in the industry for he was the first man to introduce the suction dredge in the South and the business enjoyed by Jahncke Service today is a fitting monument to his energies and ability. The business is now carried on by his three sons; Ernest Lee Jahncke is president of all the Jahncke companies and devotes his entire time to the operation of the dry-dock and ship-repair concern. Paul F. Jahncke is vice-president of the different companies and devotes his time to the operation of the various sand and gravel plants and to the dredging business. Walter F. Jahncke, who is so widely known in the sand and gravel fraternity, is secretary and treasurer and gives his time to the sales end of the business and to the general management of the offices.

Walter F. Jahncke

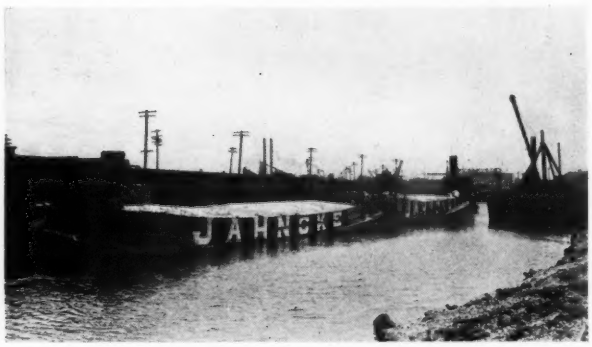
Sand and Gravel Plants

One of the largest sand and gravel plants operated by the Jahncke Service is at Brookhaven, Miss., on the main line of the Illinois Central railroad. For road gravel and ballast the company em-

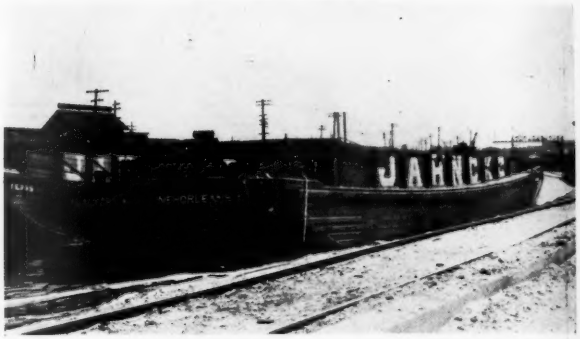
Yard showing ground storage, bunkers and gantry crane



Close-up of bunkers for wagon and truck loading. Gantry crane loads and unloads



Towing barges down Basin Canal



Barge at landing ready to be unloaded

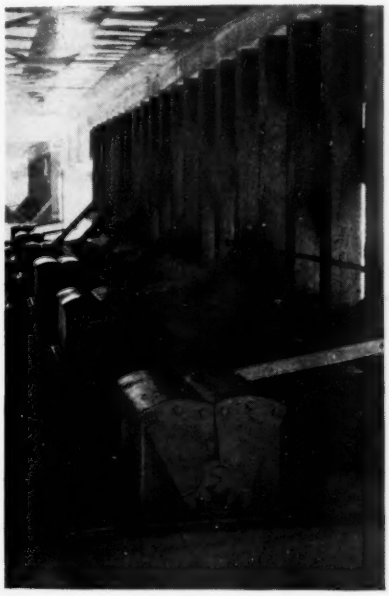
Unloading barges with locomotive crane and floating derricks equipped with clamshell buckets

Barges from Lake Ponchartrain. Locomotive crane deposits material at ground storage or loads direct to cars

Types of trucks used for delivering materials in the city

ploys a Bucyrus steam shovel with a 2½ cu. yd. dipper for excavating and loading the bank-run material into cars. The capacity here is approximately from 200 to 250 cars of material daily. At Brookhaven the company also operates one of the most up-to-date washing and screening plants in the South. This plant has a capacity of from 35 to 40 cars of washed gravel and from 10 to 15 cars of mason and concrete sand daily. The switching and hauling of cars are done by the company's own locomotives.

Another plant is located at Roseland, La., on the Illinois Central railroad. The operation here consists of a suction dredge equipped with a 10-in. centrifugal pump which delivers the material through



Beaumont gates underneath system of bunkers

a pipe line to a concrete sump at the foot of the washing plant. A 10-in. booster centrifugal pump takes the material at the sump and elevates it to the top of the washing plant, a distance of 60 ft., for passage through a set of eight conical screens, where the material is sized and delivered to its respective bins. The plant has a capacity of 20 cars of washed gravel and 10 cars of concrete and mason sand daily.

At Roseland the company is installing another 10-in. centrifugal pump and dredge unit of the latest and most improved design for handling sand and gravel. When this unit is in operation the material will be passed over gravity screens and the Roseland output will be increased to approximately 50 to 60 cars of washed gravel and 15 to 20 cars of concrete and mason sand daily.

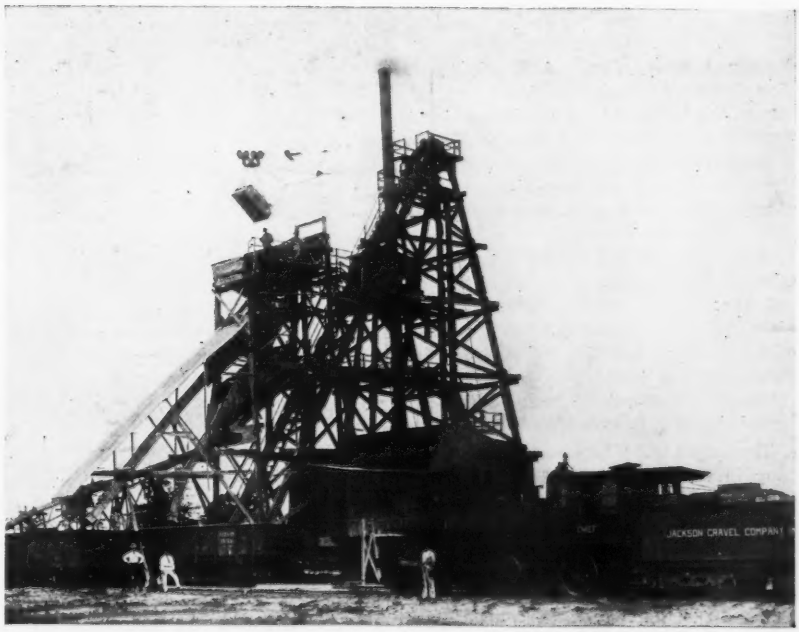
One of the building material yards

At Jackson, La., the company operates a very simple plant. The material is excavated by a Sauerman 2½-cu. yd. dragline cableway excavator which spans a creek over a distance of 900 ft. The material is passed over a gravity screen and loaded direct into cars. This plant has a capacity of from 10 to 15 cars of gravel and from 8 to 10 cars of sand daily. This plant is on the Yazoo and Mississippi Valley railroad and operates under the name of the Jackson Gravel Co., but it is a subsidiary of Jahncke Service.

Another Jahncke operation, known as the Louisiana Gravel and Sand Co., Foxworth, Miss., is on the New Orleans and Great Northern railroad. The equipment here consists of a 10-in. centrifugal pump and dredge unit and a screening plant, the capacity being 15 to 20 cars of gravel and 8 to 10 cars of sand daily.

Wharves and Yards

Sand, gravel and shells are brought into New Orleans on the Basin Canal from various points across Lake Ponchartrain, La. For handling the material after it reaches the city several different types of unloading devices are used. At one landing a 15-ton Brownhoist locomotive crane unloads the material from the barges and distributes over ground storage or loads direct into cars. Also, several floating derricks equipped with 1½-cu. yd. Hayward clam-shell buckets are used to unload material from barges. A floating belt conveyor, 100 ft. centers, with a swing of 360 deg., is used to distribute material to storage when unloading must



Jahncke operated sand and gravel plant at Jackson, La.

be done over streets and other obstructions.

At another landing a Shephard electric gantry crane with a span of 95 ft., operating over a distance of 365 ft., is used to unload material from barges, distribute material over ground storage, load into cars or bunkers, or vice-versa. This method of storage is very flexible.

For city delivery of sand, gravel and crushed stone the company maintains a system of bunkers along the canal landing. The material is loaded into these bunkers by the various devices hitherto mentioned. The flow of material from the bunkers to the wagons or trucks is controlled through 20x20 in. standard Beaumont duplex gates manufactured by the Beaumont Mfg. Co., Philadelphia, Pa. The company operates a fleet of 35 motor trucks and 30 mule teams for city delivery of materials. In all, the company maintains eight yards and warehouses throughout the city so that deliveries more convenient to certain localities can be better taken care of. Repairing, washing and general maintenance of all the equipment is performed by the company itself.

Oyster Shell Plant

New Orleans has quite a reputation as a town where one can obtain an abundance of good sea food, and consequently that city's safes and restaurants have an abundance of oyster shells to dispose of at good advantage. Jahncke Service buys these shells, and after crushing and pulverizing, markets the resultant product as a chicken grit, agricultural limestone, etc.

Every morning the company sends out a man who gathers the shells from the restaurants and delivers them to a ground storage located at the crushing plant. The shells are then loaded into a 1-cu. yd. car which is hauled up an incline by a hoist and deposited in a hopper feeding a rotary dryer. The drier removes all excess moisture from the shells and also eliminates a great deal of the adhering dirt. From the drier the material is fed to a small Jeffery pulverizer, from which it is reclaimed by a bucket elevator and fed to a sizing screen. The over size from the screen goes back to the drier, while the fine material goes to the bins ready for loading. The crushed shell makes an excellent grit and agricultural limestone, as it is very high in calcium.

The various Jahncke interests employ in the neighborhood of 2000 men. The company maintains that the building-materials dealer is a necessary link between the manufacturer and builder which cannot be dispensed with because the dealer is performing the work of distribution at the lowest possible price consistent with good service.

Why Stone Men Will Not Take Part in I. C. C. General Rate Hearings

A. P. SANDLES, secretary of the National Crushed Stone Association, and of the National Agricultural Limestone Association, in a bulletin of the latter association dated January 25, explains why the crushed-stone men are not keen to take part in the general rate hearings now in progress in Washington.

Mr. Sandles states: Immediately after "Agstone" meeting at Columbus, I wrote letter to James R. Howard, president, American Farm Bureau Federation, asking the Federation's assistance in securing reduced freight rates on Agstone. Mr. Howard referred this letter to C. B. Hutchings, American Farm Bureau Federation traffic manager, who is in Washington and has been handling the rate question on agricultural shipments. This morning, January 25, I received the following letter from Mr. Hutchings:

Mr. A. P. Sandles, Secretary, The National Limestone Association:

Your letter of January 14 has been forwarded to me here in Washington. I am, of course, vitally interested in securing a proper adjustment of the rates on agricultural limestone and fertilizer; at the same time I am not wholly convinced that it is wise to shoot all our ammunition at the present hearing of the Interstate Commerce Commission, for the following reasons: In the first place, agricultural limestone as a rule moves under very different circumstances in the different localities—a proper rate adjustment in Illinois is wholly improper for Ohio; neither would fit in New York state, and Virginia has still a different problem. With the present tendency of the Interstate Commerce Commission toward ironing out discrimination by raising all the rates to the higher level, it appears to me that there is a very serious chance of having our fingers burned if we drag in the limestone rates.

In the second place, we have had excellent success by negotiating direct with the railroads in various localities. Ohio and Virginia are the only places where the matter has been appealed to the state commissions. The Iowa commission inaugurated a general investigation in regard to rates on sand and gravel, which include all stone rates, and told us to go and fix up limestone rates by conference with carriers. Certainly we do not want to tie the hands of organizations who are dealing with railroads direct by throwing all this question into the pot here at Washington.

In the third place, I am not at all sure that general investigation is the proper place for presenting our troubles on specific commodities. In this proceeding the I. C. C. is primarily interested in fixing the rate of return to the railways, and not to determine whether any reductions at all are possible. Individual commodities are likely to be given scant consideration and receive no reductions. In that case, both carriers and commission will say that our case has been decided against us and refuse any relief in the future.

Frankly, I believe that agricultural limestone and fertilizer have as good a case as any commodities which can be brought before the commission at this time. If you are insistent that this question shall be brought up, it may not be amiss for us to present our united strength in such endeavor, but I would commend to your very serious consideration the objections which I have raised, and which are founded not merely on my observations of the situation, but also upon some indications of attitude of commission itself.

Rates on Silica Sand From Illinois to Missouri Held Unreasonable

EXAMINER R. L. Shanfelt has recommended the dismissal of No. 12469, Silica Sand Producers' Association vs. Missouri Pacific et al., on a holding that the rates on silica sand from Ottawa, Wedron, Millington and Oregon, Ill., to Armourdale, Kans., had not been shown to be unreasonable or unduly prejudicial. The complainant so alleged to the extent that they exceeded those from Pacific, Gray's Summit, Klondike and Crystal City, Mo., by more than 30 cents per ton.

Attorney-Examiner Arthur R. Mackley in a report on No. 12834, Victory Window Glass Co. vs. A. T. & S. F. et al., recommended a holding of unreasonableness as to a rate of 32.5 cents on silica sand from Gray's Summit, Mo., to Augusta, Kans., via the Missouri Pacific and Santa Fe, prior to March 27, and a rate of 21.5 cents via the Missouri Pacific and Frisco before and since that date. He said that a reasonable rate would have been 13.5 cents and that reparation should be made to that basis. The Frisco, at the hearing, expressed a willingness to establish the 13.5-cent rate in connection with the Missouri Pacific.

Millions of Tons of Lime Needed in California

LIME requirements in Northern California aggregate millions of tons, according to University of California soil experts. The natural supply has been leached out by drainage and cultivation and the farmers must replenish the supply.

At the same time farmers are warned against a too liberal application of caustic limes or limes not already carbonated as the soil is low in humus content. The university's farm advisers and agents will seek to discover lime deposits that can be operated locally. An investigation of marl deposits is being made by both university and state authorities. In the Bernal deposit of shell marl in the Santa Clara valley there are more than 50,000,000 tons of marl that analyzes about 90 per cent of carbonate of lime.

China's Share of World's Mineral Output

FROM a report recently issued by the Georgraphical Survey of China, the following figures are taken showing the world's mineral production in 1916, including China's proportionate output in minerals in the rock products industry:

	Tonnage.	Total value.	China's production, %
Gypsum	4,800,000	$ 25,000,000	0.6
Talc	250,000	4,000,000	4.0
Asbestos	160,000	20,000,000	3.0
Magnesite ..	800,000	16,000,000	1.2
Potash salt..	11,000,000	100,000,000	.0
Phosphates ..	4,000,000	56,000,000	.0
Nitrates	3,200,000	252,000,000	....

China's mineral production is less than 1 per cent of world production, and while that country is not poorer than the average in mineral resources, the report that she is enormously rich is undoubtedly erroneous.

"Concrete Is as Good as Materials from Which It Is Made"

To Combat Side-of-the-Road Material, Producers Need Lower Freight Rates—And Some Other Things, Too

DURING the height of the freight-rate controversy ROCK PRODUCTS put the following proposition up to a number of state highway engineers, consulting engineers and contractors—users of aggregates: Commercial aggregates, with a handicap of high freight charges, have to recommend their use quality, service, responsibility and the preservation of an industry which most certainly will some day be very much needed. Taking these things into consideration what is the differential in cents per ton in favor of the commercial material, beyond which the freight charge must not go, if the commercial material is to be used in competition with a local product?

Obviously this is asking a specific answer to a very indefinable, general proposition; and the answers were naturally rather indefinite. The real object of the question was to see how specific the ideas of some users of aggregates would be. Truly the best answer is that at the head of this page, given by R. R. Cunningham of Cunningham & Melson, general contractors, Newport News, Va., *"We know from experience that concrete is as good as the material from which it is made."*

That statement opens up the whole issue involved. In construction economics a material need not be better than necessary to perform its function satisfactorily. All concrete need not be good concrete. There may be conditions and circumstances that justify the use of horse dung as an aggregate; and there may be conditions which compel the use of the very best trap rock. One concrete can not be compared with the other and an estimate made that the trap rock was worth 1.39 cents more per ton than the horse dung, unless the use to which the concrete is to be put is taken into consideration.

Most producers with whom we have talked or corresponded are liberal-minded enough to recognize that there may be conditions which justify the use of local material, for they recognize that they are as much interested in the ultimate economy of the public work as any other citizen; even though it does temporarily injure them as producers. In the last analysis any business or any industry must survive or perish according to its true economic importance.

We believe that the commercial aggregate industry is of very vital economic importance. It has come into existence under our own observation during the last 35 or 40 years in response to a very insistent demand on the part of engineers, architects and contractors for quantity, quality, service and responsibility, and so long as the industry can give these things there will always be an economic need for it, measured roughly by the volume of concrete work done—and certainly nobody, not even the steel manufacturers, look for any diminution in the use of concrete.

When it comes to highway work and much other public work involving the use of large quantities of cement and aggregates the question of what is ultimate economy is also more or less debatable, because always the quality of the finished product involves the problem of whether it is good enough to serve the purpose intended. Until very recently every one has accepted the more or less snap judgment of an engineer or other official, without much study or questioning. This condition is changing and the United States Government and the state governments are working jointly and individually to try and solve the economic problem scientifically.

Must Co-operate with Users

Producers must then familiarize themselves with these matters. They must co-operate with the users of their materials. They must make the very best products they can from raw materials available. They must give and emphasize service, quality and willingness to stand behind their product. They must know as much as and more about their product and the various uses made of it than those who buy it. They must gain and pass on this knowledge in a spirit of the most friendly co-operation with the buyers and users—because the commercial aggregate industry is founded on the assumption that it is a necessary useful adjunct of the construction industry.

Did you ever hear of a business, or an industry, that succeeded and waxed rich and strong which consistently ignored or antagonized its customers? Certainly not, unless the industry produced something that had no substitute or could not elsewhere be obtained. It seems logical then to believe that the commercial aggregate industry has everything to lose and nothing to gain by antagonizing and working at cross purposes with the users of aggregates.

What Engineers and Contractors Say

It is always interesting and instructive to see ourselves as others see us, and what follows is published for that purpose and no other; by no means do we subscribe to *all* the sentiments expressed:

A. R. Hirst, state highway engineer of Wisconsin, writes:

"We use the one or the other in our concrete road construction just as the one or the other is the cheaper to deliver to the mixer. Both are accepted or rejected on the same specifications, and there can be no choice as between the two except the choice resting on price.

"Of course, if commercial aggregates were sized so as to give the minimum voids, thus enabling a saving to be made in the amount of cement required, while the roadside aggregates were not (as it is usually impossible to size them or re-proportion them in small plants), there would be some reason for preferring commercial aggregates, but as a matter of practice it is impossible to translate into actual construction small differences in void contents, so that for all practical purposes all aggregates offered must be placed on a common ground.

"While on the average in Wisconsin the commercial material is a small fraction superior to the average roadside material, this is not always true and it is quite often untrue. I have never seen a reason advanced why we should pay more for commercial aggregates than for roadside aggregates, when the roadside aggregates were properly prepared as they are in Wisconsin.

"In the average year the service from the roadside pit is infinitely superior to the service from the commercial pit depending upon railroad haul. As a matter of fact, this is the first year (1921) in six that railroad hauls have been at all satisfactory, and unless the American railways fit their equipment better than they have shown any evidence of doing we can expect trouble from car shortage next year (1922), which is going to be, in my opinion, the largest construction year in American history.

"Incidentally, I believe that there is going to be more than enough business to go around in 1922, and if the stone and gravel producers would concern themselves more largely with securing railway service and reasonable railway rates, and less largely with warring upon roadside production, which is a small factor in the whole situation, we would all be better off. Freight rates are too high and from present indications railroad service is going to be poor next year. It is on these two things that the fate of commercial pits and quarries depend, and not upon roadside production, because there is only a small percentage of all operations which can be supplied economically from roadside plants."

M. R. Amerman, contractor, Wichita, Kan.:

"On the many jobs that I have done in this state and in Oklahoma I have very frequently used what you term road-

side material, that was easily gotten in the vicinity of the job, so as to overcome the disadvantage of high freight rates. Of course at all times the material thus secured has been required to meet the specifications of the job.

"From a contractor's standpoint the material business is always more or less of a disadvantage to him and it requires more capital to conduct a job where he secures local material than when he has it shipped in from large material companies. Personally, and I know that my opinion coincides with that of most every contractor, the material business is not our business and we would always prefer securing material from the large concerns if the freight rates were such that we could use this material without a serious financial loss or handicap. I feel that the railroad companies are standing practically in their own light in this matter and greatly reducing their tonnage and volume of business by continuing the high rates on road-building and construction material."

W. S. Keller, state highway engineer of Alabama:

"I am one of those engineers who believe in the use of local material wherever it is possible to find it, provided the material is suitable for road surfacing. In this state we are very fortunate in having large deposits of gravel and other road-building materials well distributed over the state. The one great advantage of local material is the fact that it is always at hand for maintenance and the state is not dependent on railroads and material producers for such maintenance material."

Ernest S. Alderman, state engineer of Oklahoma:

"It would appear from your letter that you have assumed that the material produced by commercial plants is prepared with the idea of meeting the specifications and that material from local plants is prepared in a haphazard manner.

"Judging from the record of rejections in this state, I would say that the commercial stone and gravel producers as a rule are quite independent and make little effort to produce material as called for by the specifications or desired on the work; and as a matter of fact in some cases the quality of the roadside material is superior to that produced by the commercial quarries.

"In numerous instances it has been necessary to require commercial stone products to be re-screened after arriving at their destination and in other cases it has been necessary to make total rejection, and in all cases I feel that this was due to a lack of care on the part of the shipper.

"There is a large portion of this state where there is no local material available and in this part of the state as well as in the remainder of the state regularity of shipments and uniformity of product are very desirable features, which could be had from commercial quarries, but at the present time, I am unable to give you any differential in favor of the commercial material."

G. A. Draper, office engineer, Mississippi State Highway Department:

"We do not permit the use of any aggregates which have not been washed, screened and graded."

W. R. Crum, engineer of materials and tests, Iowa State Highway Commission:

"We are satisfied to use any materials which comply with our specifications. As to whether the material is prepared in a large commercial plant or in a small and perhaps temporary plant at the site of the work, is of very little consequence, if the material itself conforms to the accepted standards when it is delivered to the work."

I. W. Patterson, chief engineer, Rhode Island State Board of Public Roads:

"It seems to me that it is very difficult to determine a differential in cents per ton which would apply generally in favor of commercial material. All engineers, presumably, are opposed to the use of inferior aggregates for concrete. The production of the aggregates upon or nearby the site of the work, it seems to me, does not inevitably mean the securing of inferior products. It is our practice to study the conditions in advance of the awarding of the contracts and to specify either commercial aggregate or aggregate secured locally depending upon conditions. If it appears feasible to secure the aggregate locally, specifications are drawn which regulate the character of the product. As a matter of fact we employ commercial aggregates upon a very large percentage of our work. I do not feel justified, however, in attempting to arrive at an estimate of difference in value between the commercial product and the local product which applies generally."

W. P. Moore, chief engineer, Tennessee Department of Highways:

"Under some conditions in Tennessee we are able to prepare the aggregates along the roadside to an advantage that could not be met by commercial plants. We have other sections in which we are entirely dependent upon commercially prepared aggregates. As a matter of comparison I will state that the commercially prepared aggregates are very much to be desired over those prepared along the side of the road.

"I am frank to admit that unless something is done to protect the commercial interests furnishing road material that they will be forced out of business, and when they are forced out of business it will mean a shutting down of the general construction work over the whole country.

"Any effort this department can make to procure a reasonable adjustment of the freight rates on road-building materials will be gladly made. I might add that we have induced our State Public Utilities Commission to institute proceedings against the railroad companies in the installation of certain freight rates ordered by the Interstate Commerce Commission. We believe that there is a state rights legal question that has been violated by the Interstate Commerce Commission and under this belief we are going to try it out in the courts.

"As to the exact differential between the material produced by the commercial quarries and the local quarries I am compelled to admit that this is controlled so materially by local conditions that I cannot give you an accurate estimate."

Clarence Blakeslee, of C. W. Blakeslee & Sons, general contractors, New Haven, Conn:

"As a general proposition the commercial aggregates are much more preferable than the ordinary material that is found alongside the road, and, in my judgment, this commercial aggregate (stone and sand) is worth, to a concrete road especially, at least 75 cents to $1 per ton more than the local material.

"Of course, it is hard to make this statement to apply in all cases, for here in New England, for instance, certain localities furnish trap rock and granite of equal quality to material that might be shipped in from outside. The same also applies to sand; but, where the rock and sand are not of superior quality, my statement of 75 cents to $1 more a ton stands, and in many instances, of course, the differential would be a great deal more, perhaps running up to $2 a ton.

"We have just finished an 18-ft. concrete road, 35 miles long, through a section where the rock aggregate was so inferior that the differential on this particular aggregate was over $2 per ton. By washing sand, we were able to use it, as it was almost impossible to ship in sand. Had we been able to procure the sand from outside, the differential in favor of the outside sand would probably have been $1.50 per ton."

R. C. Limerick, state highway engineer, Arkansas State Highway Department:

"In this state the use of all aggregates is based on their compliance with the state standard specifications, and conditions are such that in many cases we are able to secure local aggregates of an equal quality with commercial aggregates and at a much less price. Of course, where the quality varies considerably and local aggregates will not meet the specifications, I favor the use of commercial aggregates. The differential in cents per ton that might ordinarily be placed on the two materials is about 20 or 25 cents.

"The material situation in this state makes it rather hard for me to answer the questions in the way you have asked them. It is a fact that our sources of supply for commercial aggregates do not furnish in several cases a high-grade material. One of the largest quarries in the state produces trap and sandstone and much of this material as produced contains a high percentage of slate and shale. Another quarry that is operating is working in a rather soft sandstone and it is sometimes difficult to secure a satisfactory material. On the other hand, it frequently happens that by the use of portable crushers we are able to secure an equally good material or better material than can be gotten from the commercial quarries."

James A. Davis, chief engineer, Division of Highways, State of Washington:

"We do not favor the use of commercial aggregate in preference to the aggregate obtained from the side of the road, provided that the material is the equal of the commercial aggregate. Sand and gravel deposits are very widely distributed in this state and we are often able to find material at the side of the road that is equal to the commercially produced material.

"It is absolutely necessary to use a proper grade of clean and sound aggregate for the construction of one course portland cement concrete pavements.

"We do not place a differential in favor of commercial material provided the side of the road material is equal to the commercial material and the differential would depend upon the value of the materials for the purposes intended."

John H. Mullin, chief engineer, Minnesota State Highway Department:

"This office favors, as an engineering proposition, the use of aggregates furnished by commercial plants rather than material found alongside the road in the construction of concrete pavements. At the present freight rates, however (writtten before the reductions noted in the January 14 issue), we are obliged to look about for means of doing our work with local materials, and we are making a study of that situation at the present time. Various methods have been advocated and if the cost of transportation is to remain at a high figure we will try to so revise our specifications as to provide for the construction of pavements by

the use of local material when possible. This may be accomplished by building a heavy mass for the pavement proper and incorporating in the top a layer of hard rock or it may be by some other means. However, we hope that this will not be necessary as we are getting high-class work under our present specifications and we know that with clean, well graded aggregates the pavements will last for an almost indefinite period."

T. H. Johnson, consulting municipal engineer, Sioux City, Iowa, (the man who made Sioux City concrete pavements famous):

"In the building of pavements there are three interests to be reckoned with, the user and the payor, the engineer and the contractor. He for whom the pavement is being built wants the greatest mileage in the shortest possible time, and at the lowest cost. The engineer's first consideration is quality, coupled with steady quantity production, while the contractor's concern is centered in the greatest yardage with the largest margin of profit.

"Those factors that contribute in the largest measure toward the accomplishment of these several purposes should receive the most careful consideration by all the interests concerned. The one thing that is absolutely essential is a dependable supply of uniformly good materials. Clean, hard, well-graded sand and gravel, or crushed rock, in the desired quantities are obtainable only where the necessary facilities are at hand for producing them. Clean, properly graded materials not only make a better pavement, but they make it for less money, because of the smaller proportion of cement required. This saving in cement is often sufficient to offset the greater cost of the better aggregates, to say nothing of the improvement in the quality of the pavement.

"In the building of concrete pavements the one big word is *UNIFORMITY*. Uniform quality and uniform grading of aggregates is of the greatest importance. These qualities are seldom if ever found in roadside materials. To make these materials acceptable, they must be washed, screened and remixed.

"When railroad transportation had broken down, and it was practically impossible to get materials from the commercial producer, some experimenting was done with less carefully prepared materials, but it is very doubtful whether experience anywhere indicated a cheapening of the product where care was exercised to maintain the quality.

"Because of the varying quality of 'roadside' materials, it is difficult to place an exact differential in favor of properly prepared aggregates, but the difference between this kind of materials and that usually found along the line of the work, may easily mean a difference of 50 per cent in the life of the pavement."

H. M. Loy, assistant state highway engineer, Nevada Department of Highways:

"In this state, usually pits do not occur with a uniform grading in any quantity; also cement costs are relatively high, and it is therefore economical for us to screen the material and properly proportion it in order to save the use of excess cement. It is hardly possible for us to place a differential in cents per ton in favor of the commercial product. Approximately one-third the total cost of concrete work here is in the aggregates. Therefore, assuming that with the same cement content a 10 per cent greater strength could be secured by using a properly proportioned instead of one not properly proportioned and graded, it would be economical for us to pay approximately 25 per cent more for screened, washed and graded material."

Leon C. Herrick, director of highways and public works, State of Ohio:

"Wherever local material is available and meets the specifications, naturally this department permits its use. During the high freight rates, it was the policy to perhaps lower our specifications where it could be done consistently to permit the use of local material and avoid excessive freight rates.

"On the other hand, we are firm believers in having the material which is used in accordance with high standard specifications. You will readily see, therefore, that it would naturally have to be taken up in some particular instance to answer your questions definitely."

Julius K. Monroe, project engineer, State Road Commission of West Virginia:

"We believe that there is no question as to the economy of using properly prepared aggregates—that is, aggregates that have been washed, screened, cleaned and graded, but we could not state just what differentials in cents per ton there may be between this class and that which may be found along the different projects proposed to be constructed as there is a great variation in the quality of these materials.

"The question of cost and transportation, of course, enters largely into these matters and each project is a problem in itself to be solved."

W. H. Robinson, chief engineer, North Dakota State Highway Commission:

"The supply of good gravel in North Dakota is very small. Many of the gravel pits that have been used before federal-aid road construction was started in this state cannot be used on account of the shale which they contain.

"We have therefore found it imperative to insist that all gravel and sand be washed and screened into the proportions required by our specifications and to also meet the requirements of the United States Bureau of Public Roads.

"Contractors doing work in the eastern part of the state have been obtaining, in some cases, gravel from the pits in Minnesota. Contractors doing work in the central and western portion of the state have been obtaining gravel from a pit which has a screening and washing plant near Mandan, N. Dak. Freight rates have therefore made up a large part of the cost of a yard of concrete.

"We are engaged at the present time in compiling a list of all the gravel pits in the state and are submitting samples of this gravel for test to the United States Bureau of Public Roads. Gravel has been used, of course, from other pits than the Minnesota pits and the plant mentioned at Mandan.

"It is our opinion that practically all the gravel used from this state will have to be washed and screened at several central plants."

Fred E. Ellis, general contractor, Melrose, Mass.:

"If the local aggregates are equal to the imported, in fitness for the work, and the cost is the same or lower when used in the road, the use of local material is justifiable.

"If the local aggregates are not equal to the imported, in fitness for the work, or the cost is more, then imported material should be used.

"I do not believe that any freight rate that would be allowed by the I. C. C. or P. S. C., however large, would increase the cost of the mineral aggregates enough to justifiably excuse anyone in using an, in any way, inferior local aggregate that is to be combined with expensive bituminous material or portland cement.

"Most of the failures of road surfaces have been due to the use of unsuitable mineral aggregates.

"I believe the railroads should be allowed to make a reduction in rates to meet any special competition, without waiting the 30 days or receiving the approval of anyone or anybody.

"As the railroads are the largest taxpayers and the taxes they pay are being used to build untaxed highways that are used for free and unregulated traffic in direct competition with the same overtaxed and much regulated railroads, I believe the railroads ought to be allowed to use their own judgment as to the rates on road-building material. It may be all right to hang a man, but to make him buy and procure the rope and furnish the money to build the trap seems unreasonable."

Carl W. Brown, first assistant engineer, Missouri State Highway Department:

"There is undoubtedly **real economy in** the use of properly prepared aggregates that have been washed, screened, cleaned and graded, as against ordinary aggregates, or, as you express it, side-of-the-road stuff.

"However, I cannot say what differential in cents per ton we would place, as the local materials are very seldom similar for any two localities, and do not favor using this material in any way if it does not at least meet the requirements of our standard specifications. However, a great part of our state has materials available, either adjacent to our construction work or a very short haul, which have been meeting our specifications in all respects, and except in a few parts of the state have not had the disadvantage of long hauls. However, there is a very decided advance in the cost of work owing to the excessively high freight rates where materials are shipped any great distance."

M. W. Watson, state highway engineer, State of Kansas:

"It depends entirely upon the differential in cost of the two materials. With the present high freight rates we find in many instances that it is more economical to operate a local plant than to ship material from existing commercial plants for long distances.

"In general, I would say that the contractors prefer to purchase material from commercial plants, if the same can be secured at a reasonable figure, as they do not care to equip themselves for producing the material in addition to the expense necessary to build the road."

Joe S. Boggs, state highway engineer of Kentucky:

"This department favors the use of commercial aggregates as against local materials when such local materials fail to meet our specifications. Kentucky, however, is fortunately situated in that alongside many of our main trunk line highways there are splendid deposits of limestone."

John N. Eddy, chief engineer, Montana State Highway Commission:

"This department favors the use of commercially prepared aggregate on paved road projects. However, it should be noted that Montana's road program involves the construction of a larger mileage of gravel roads than of any other type and for this work we must make use of the best of the "stuff found by the side of the road" or in the immediate vicinity."

Many more such paragraphs could be quoted, but here are enough to show that highway engineers, consulting engineers, and contractors are in most every case in thorough sympathy with the commercial aggregate industry, but they make it clear that the problem is an economic one—a very difficult economic one—which needs constructive ideas, investigation, thought, work and experience on the part of all the parties involved—and that's all of us—and not a spirit of aloofness, antagonism and knocking.

The producers have rights that must be defended by them and recognized by the others, but the basis of the industry is service, quality, quantity and uniformity of product and the acceptance of responsibility for all these. On one or all of these grounds only is the commercial product sure to excel the side-of-the-road competitor; and in not one of these particulars is anything to be gained by mere controversy without the definite object in view of helping to solve the problem of the best road for the least money and a maximum of service.

European Progress of Cement Manufacturers

Recent Development of Fused Cement, and Artificial Cement from Re-burning Hydraulic Lime and from Shaley Rubbish

SINCE 1914 some ingenuity has been devoted to research, and a few new ideas have been brought to light in the cement industry, where we have witnessed the appearance of fused cement; then artificial cement made by re-burning hydraulic lime in the rotary kiln, and finally artificial cement made from the shaley rubbish from coal mines, etc., says the *Revue des Materiaux de Construction.*

As hitherto manufactured, fused cement is composed of a mixture of carbonate of lime and bauxite, burned to complete fusion, the bauxite being the new ingredient. It was utilized by M. Bird at the Pavin de Lafarge Works to manufacture fused cement in two stages: (1) a preliminary calcination, for which the coke required was 75 per cent of the cement produced; (2) fusion in an electric furnace where the fuel consumption represents 2500 kw.-h. and 10 per cent in electrodes per ton of cement produced. In spite of this double treatment the cost of production is said to be less than with the ordinary cement kiln, in which the fuel consumption is very heavy.

Endeavors have also been made to manufacture fused cement in rotary kilns at the Gargenville works, but the results are not yet known. It is, however, stated that fused cement from electric furnaces could be sold for £11 per ton when the cost of electricity is ⅛ d. per kw.-h. This fused cement is a product with a special composition, very aluminous and ferriferous, and differing greatly from the more siliceous cement made by burning clayey limestone.

According to the theories hitherto accepted, fused cement would be quick setting on account of the larger proportion of aluminous and of low strength, owing to the small percentages of silica and lime. Results obtained, however, contradict this, and it has been found that fused cement only begins to set about 2 hr. after mixing and attains its maximum resistance in 72 hr. This new product, though expensive, may be useful in some cases when a cement is required to give a great resistance in three days. Cement made from twice burnt hydraulic lime in the rotary kiln, or by overheating it so as to form a clinker which, when ground, gives a cement of much greater strength than the corresponding lime. Hence it is an artificial cement. Were this so, the Le Chatelier theories hitherto admitted, would be false. Such, however does not appear to be the case. On the contrary, the results confirm these theories regarding the constitution of cement. The lines thus treated are highly hydraulic with a great percentage of silica, and their composition as to silica and alumina is similar to that of cements. The result of burning such materials in a shaft kiln are an eminently hydraulic lime—that is, a mixture of carious silicates and fat lime, and when it is burnt again in the rotary kiln to form a clinker, the silica, alumina and lime are combined to the maximum degree of affinity.

Thus, all the silica and alumina is transformed into silicates and tricalcic aluminates, and the product is a true cement clinker, with an excess of free lime. The more hydraulic the lime the greater the strength obtained. It will be more or less regular according to the more or less constant percentage of clay in the original limestone. Finally it will be very slow setting for free lime delays setting. This is the result of the application of the theories now accepted as to the second burning or clinkering of hydraulic lime in the rotary kiln.

Mile Shale Cement

The composition of the shales from French coal mines is rather variable, but the following may be taken as the average:

	Per Cent
Fixed carbon and volatile matter	40
Silica	36
Alumini	9
Iron oxide	9

This represents a silico-aluminous material favorable for manufacture of cement, as it also contains the necessary fuel for burning. About 100 parts by weight of such shale is mixed with 240 of limestone containing a small percentage of clay and ground to powder. This powder will contain 40 of coal and should yield, when burned, 200 parts of cement, without the employment of any other fuel, but this method has not yet been practically realized, and it seems a difficult problem to handle.

In the first place, mine shale is very variable in composition, and for good cement the raw materials must be uniform, the proportions of silica and alumina varying only to a slight degree. Moreover shale is much harder than the clay usually employed, and the cost of grinding would be greater. With a vertical kiln the materials would have to be briquetted, for which powerful presses would be needed, the briquet would be friable, and the cement made defective. Thus great care must be taken in selecting the shale and the existing systems of manufacture do not appear likely to give satisfactory results. Nevertheless, the idea is interesting. Just as with bauxite, fused cement has been obtained which gives excellent results. In the case of shale it may be found possible to alter the present systems of manufacture for its utilization, but all this has to be investigated and it may prove expensive.

Railways Bureau Organized by The Portland Cement Association

THE Portland Cement Association has just organized a railways bureau at its general office in Chicago. This new bureau will facilitate service available to railroad men through the resources of the Portland Cement Association for compiling and presenting authoritative data on railroad uses of concrete. Railroad officials have long realized the value of keeping abreast of developments in concrete construction and will appreciate the better service contact they are thus afforded.

D. A. Tomlinson, the manager of the new railways bureau, himself a railroad man, for the past two years has been connected with the association's structural bureau, and thus has a knowledge of concrete and of the work and facilities of the association, in addition to an understanding of railroad problems.

Hints and Helps for Superintendents

Gland Water for Pumps

GLAND water for a pump must come from an unfailing source, and the pressure must be at least a pound for every foot of elevation, according to Charles Lobbe, in the *Engineering and Mining Journal*. The best practice is to have a special tank of clear (or clear barren solution,

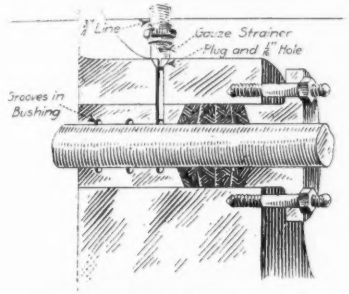


Fig. 1—Gland water connection

if the lime percentage is not high) placed in the highest part of the plant. To get the benefit of the gland, of the true pressure, the water is brought in a ¾ or ½-in. pipe, and the last nipple on the pump is reduced to 1/16 in. by plugging the nipple and drilling a hole, as shown in the drawing (Fig. 1).

There will be no chance of clogging if, in the union just before this nipple, a conical metallic gauze screen has been placed. Inspection will be an easy matter. In some pumps the gland water is connected to a loose gland-water ring placed about the middle of the stuffing-box when packing the pump; but the best practice is to connect the water to the bearing close to the packing. If there are grooves, connected together, the bearings last longer. If the gland water stops, shut down the pump at once; if allowed to run the sand will enter between the shaft and bearing, and in a few minutes the shaft bearing, packing, and gland may be worn so as to make their renewal imperative.

To protect the bearing next to the packing gland from water put a washer made of four- or six-ply rubber belting about 3 to 6 in. in diameter, fitting tightly to the shaft. If not placed when putting the pump together, the washer may be put on afterward by making a cut into one side and tightening it with wire, as shown by Fig. 2. The washer will revolve with the shaft, and any leakage will be thrown out sidewise instead of following the shaft.

Fig. 2—Bearing protector

A Blast in the Luckey Quarry

DURING the formal opening of the plant of the Luckey Lime and Supply Co., Luckey, Ohio, on July 19, a quarry shot of 18 holes was made under the supervision of H. C. King, of the Hercules Powder Co.

All holes were drilled with 5⅝-in. bits; eight of them were 35 ft. deep and were loaded with 100 lb. of 5x16 in., 60 per cent gelatine dynamite and each of the remaining holes were drilled to a depth of 18 ft. and loaded with 50 lb. of the same powder.

The result of the blast is shown in one of the accompanying illustrations. Another illustration shows block-holing methods and the loading of stone into quarry cars.

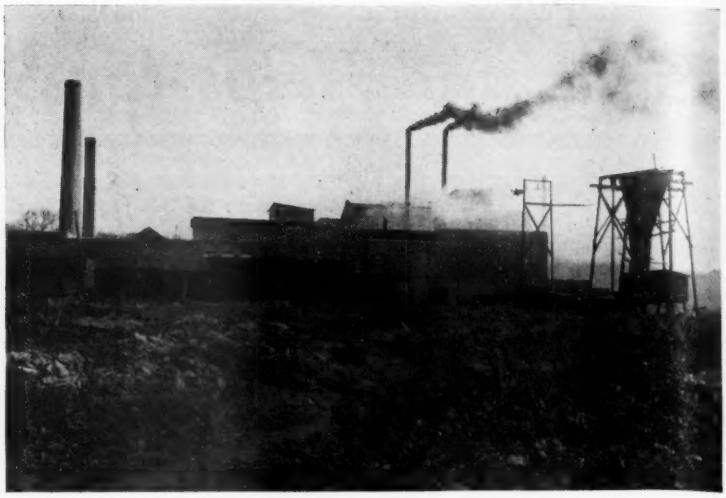
Loading Terminal for Aerial Tramway System

AT THE plant of the Iowana Gypsum Co., Fort Dodge, Iowa, the crude gypsum rock is delivered to the plaster mill from a detached crushing plant located at the mine over an aerial tramway system some 2000 ft. long. The car on the tramway is of 1500-lb. capacity and runs on two cables and is drawn by a third. The car body is suspended from the wheels. At the plaster mill the contents are automatically discharged by means of a tripper and the cars returned to the crushing plant for loading.

At this plant there is considerable demand for crude gypsum rock for use in portland cement plants as a retarder. Instead of building a special loading terminal, this company erected the type of loading terminal shown in the illustra-

Effects of a blast

Block-holing at quarry



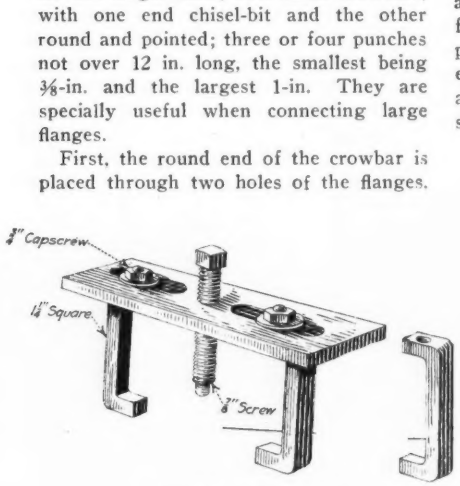
Loading terminal and car for crude gypsum rock, and loading terminal and plaster mill

tions. It consists merely of a tripper that dumps the contents of the car into a hopper and chute leading directly to the railroad car on the tracks beneath. When the contents of the car has been released the car goes on to the dumping terminal at the plaster mill, where it makes its return trip to the loading station at the crushing plant.

Useful Pump Tools

BESIDES the usual set of tools and wrenches, the pump repair man must have one set of pipe wrenches, chain tongs for the larger sizes, two small crowbars, with one end chisel-bit and the other round and pointed; three or four punches not over 12 in. long, the smallest being 3/16-in. and the largest 1-in. They are specially useful when connecting large flanges.

First, the round end of the crowbar is placed through two holes of the flanges.



Adjustable wheel-puller

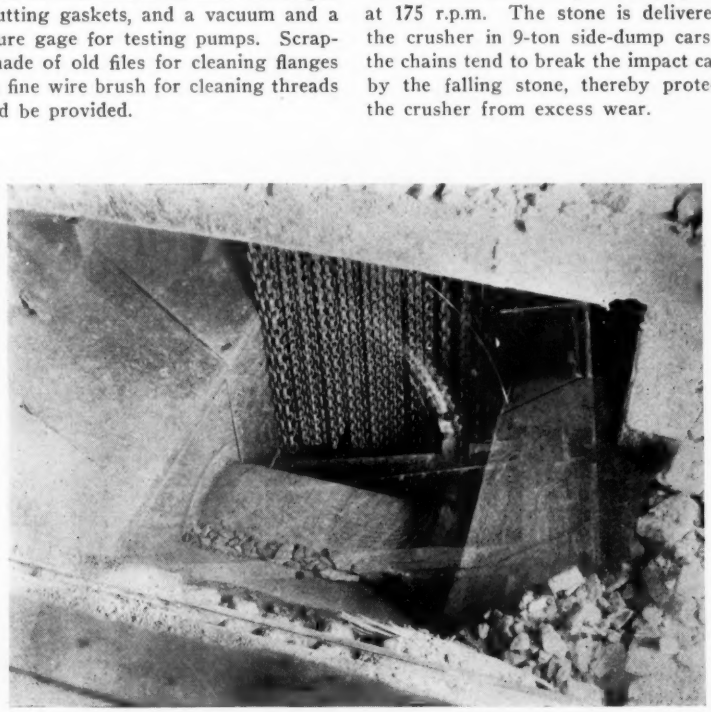
This will hold the pipe line in place. Next the gasket is slipped in, one hole of the gasket facing any hole in the flange. There a punch is driven fairly tight, the crowbar taken out, the gasket holes brought into place, and the second punch driven in any hole opposite, thus bringing all the flange holes in their exact place. The bolts are then put in the other holes without the slightest trouble, whatever size the flanges may be, and, when well tightened, the two punches are hammered out and bolts put in.

Packing hooks are of all sizes. The most commonly used are made of 3/16-in. steel wire, one end with a ring handle, the other end corkscrew. An adjustable wheel puller is used for replacing pinions and gears, pulling out bushings and valve seats. A strong wheel puller, one easy to make, is shown in the illustration. A small automobile screwjack which can be handled with one hand where crowbars cannot be used is likewise essential, as are also several chisels of different shapes for cutting gaskets, and a vacuum and a pressure gage for testing pumps. Scrapers made of old files for cleaning flanges and a fine wire brush for cleaning threads should be provided.

On pipe joints use a mixture of graphite and linseed oil. If in narrow places and under high pressure there is trouble in holding gaskets, use soft sheet zinc about 1/32-in. thick in one or two thicknesses. If taken out often, the zinc sheets must be annealed.

Chain Falls in Crusher

THE illustration shows a method of protecting a roll crusher from excessive wear caused by the abrasion of falling stone against the sides of the crusher. This Edison 6x7-ft. crusher has a capacity of 1000 tons of stone per hour, operating at 175 r.p.m. The stone is delivered to the crusher in 9-ton side-dump cars and the chains tend to break the impact caused by the falling stone, thereby protecting the crusher from excess wear.



Edison rolls equipped with chain falls

The Slate Industry in 1921

Much Progress Made in Standardizing Various Products

A CONCISE review of the slate industry in 1921 is sent us by a prominent Pennsylvania producer, who writes:

"The general condition of this industry during 1921 we have considered as unsatisfactory. At the beginning of the year we had a large volume of business left over from 1920 which was sufficient to operate our plant about three months. During the month of January cancellations of orders and contracts were heavy, which resulted in depleting of work on hand about 60 to 70 per cent. During the winter and spring there was practically no incoming business.

"From April to July the centers, in which is the largest volume of building requiring our goods, were tied up by strikes in the building trade. These set back the business that would normally be done during the summer very much. These tie-ups are mostly settled now and we are finding our business showing a slow but very steady improvement. At the present time (November 15) incoming business is sufficient approximately for 75 to 80 per cent of our present working force. So far as we can determine at this time, conditions point to a much more favorable business during 1922, provided the country is not upset by a nation-wide railroad strike and a nation-wide coal strike.

"In our industry the development of most importance during the year has been the work that has been done toward standardizing the designs and sizes of slate slabs used in the construction industry, more especially for urinal, closet and shower stall enclosures, and for switchboards, etc. This work is not yet complete, but the larger portion has been finished. These new standards have been described in detail and have been widely distributed among the architects of the country and the large builders. It is hoped that the adoption of these standard sizes and designs will enable the slate industry to produce and stock these standard designs, thereby benefiting their labor forces by giving them more steady employment in dull seasons and also benfiting the building trades by giving prompter and better service during the busy seasons.

Slate Men's Rate Case—Against Horizontal Reduction on Everything

"With respect to railroad freight rates I would say that no reduction has been made on any of the lines of goods during the past year, although efforts have been made to secure such reductions. A copy of a memorandum by Wilbur LaRoe, Jr., attorney for various slate producers in this matter, is enclosed herewith which may be of interest to you in connection with this subject."

The principal argument made by the slate quarrymen's representative was based on the fact that present freight rates resulted in unfair competition with other and newer roofing materials. The plea was made to have the railways meet these competitive conditions and institute rates under which the slate quarry industry could live and prosper. The following statements of Mr. LaRoe, attorney for the slate producers, are of special interest to all producers of quarry products:

There is no doubt that a modification of certain freight rates, especially those on heavy commodities, will help to correct a bad situation and operate to the benefit of both carriers and shippers. A horizontal reduction would be inadvisable, and will almost certainly not be approved by the Commission, because it would give relief to countless shippers who are not at all entitled to relief, and depress very substantially the revenues of the carriers, who have suffered quite as much as other industries, and who are equally in need of encouragement and assistance.

Rates must be reduced, but they must be reduced in a careful and intelligent manner, and with due regard for all the surrounding circumstances. The rates should first be reduced of those shippers who are known to be suffering so severely at the present time that they are unable to keep their plants in operation, thus depriving the carriers of revenue which they would otherwise receive. Many of the slate quarries both in Vermont and in the Bangor (Pennsylvania) region are closed, and the present output is far below normal. Slate moves in such large volume in normal times that the closing of the quarries is seriously injuring not only the shippers but the carriers. . . .

There is a special necessity for reasonable commodity rates when the commodity is of such a low grade that the freight rates represent a large percentage of the value of the commodity at destination. On June 16, 1921, the Rising & Nelson Slate Co., of West Pawlet, Vt., made the following quotation on a minimum carload of slate to a customer in Mississippi: price of the slate, $558; freight charges from Vermont to destination in Mississippi, $418. In other words, it cost almost as much as the slate is worth to haul it from Vermont to Mississippi, the freight charge constituting 75 per cent of the price of the slate at point of origin.

There can be no doubt that the rates on slate are much too high when compared with the rates on other commodities. For example, the rate on slate to Pacific Coast points is $1.92 per 100 lbs. The Pacific Coast lines recently asked the Commission's permission to establish on one day's notice a rate of $1.72 on *fruits and vegetables* from California to New York and other Eastern points. No traffic man would attempt to justify higher rates on roofing slate than the rates on fruits and vegetables, nor would the Commission give its approval to such an adjustment.

The fact should not be overlooked that the slate producers suffered considerably during the war. While producers of other building materials were shipping their products freely and receiving therefor the highest war prices, the slate producers found their commodity classed as a non-essential and almost barred from transportation. While there was an increase in the price of slate it was far less than the increase in other building materials. Furthermore, the high costs of production caused by the war conditions still prevail, and no substantial relief is in sight. And while all of these factors have operated to injure the slate industry, the inexorable law of diminishing returns is constantly at work as the producers must mine more and more deeply into the quarries for raw material.

The carriers have heretofore laid considerable stress on the fact, referred to elsewhere in this memorandum, that from the point of view of the traffic manager slate stands in a class by itself, uninfluenced by numerous factors which have played a part in determining the rates on competitive materials. This we believe to be true, but we would call special attention to the fact that this helps materially in making possible a reasonable reduction in rates on slate without necessarily embarrassing the rates on other commodities, and such a reduction would not threaten other rates on slate for the obvious reason that slate is not produced in any part of the United States except New England and Pennsylvania, at least in a volume that compares with the production in those regions. I believe that it is not subject to dispute that the rates on slate could be reduced without necessarily reducing the rates on a single competitive material.

In its report in *Ex Parte* 74, 58 I. C. C. at page 256, the Commission said:

> It is impracticable at this time to adjust all of the rates on individual commodities. The rates to be established on the basis hereinbefore approved must necessarily be subject to such readjustments as the facts may warrant. It is conceded by the carriers that readjustments will be necessary. It is expected that shippers will take these matters up in the first instance with the carriers, and the latter will be expected to deal promptly and effectively therewith, to the end that necessary readjustments may be made in as many instances as practicable without appeal to us.

The slate producers are therefore taking this step at the suggestion of the Commission, and with a view to avoiding the necessity of asking the Interstate Commerce Commission to make a formal finding in the premises. It was clearly the intention of the Commission, as is manifest from the foregoing excerpt from its report, that the rates on individual commodities should be readjusted so as to avoid the harshness and the injurious effect that would inevitably be caused by a substantial horizontal increase in rates. Although a year has elapsed since this case was decided nothing has been done to readjust the rates on slate in such a way as to avoid the inequalities and the additional burdens which the general increases have brought about. It is the firm belief of the writer that the circumstances plainly demand a substantial reduction in the rates on slate roofing; that any rates on slate roofing that are now on the sixth class basis should be reduced substantially below the sixth class basis; and that where commodity rates are now published they should be subject to such reductions as will enable the slate producers to live and enable the carriers to profit by a substantial tonnage which they are now losing.

Stone Men Have Best Convention

Chicago Meeting in Conjunction with American Road Congress a Big Success—To Tackle Technical and Business Sides of the Industry in Scientific Way

MERCHANDISING a product of unknown potentialities was the keynote of the 1922 annual convention of the National Crushed Stone Association at Chicago, January 16-18. It was attended by the largest number of producers ever gathered together, and was the most representative, geographically, of any crushed-stone convention in history—from New Haven, Conn., to Wichita Falls, Texas, and from Toronto, Ont., to southern Virginia.

Harry H. Brandon, of the Ohio Marble Co., Piqua, Ohio, started the ball rolling, early in the sessions, by pointing out some of the weaknesses in the commercial crushed-stone industry as now conducted, and by emphasizing the point that the time has come to apply modern merchandizing methods to this product. As this paper (although it is based more particularly on Ohio conditions) may mark an epoch in the development of the association, an abstract of what he said follows right here:

Mr. Sandles has asked me to talk about the thought that I tried to express in my recent letter which was published in Bulletin No. 61 of the National Crushed Stone Association. I think I made it clear what I thought to be one of the most important weaknesses of the crushed stone business, particularly in its connection with road construction.

I have asked several engineers and contractors, "Where is the weakest spot in macadam construction?" "What is the chief cause for the unsatisfactory macadam road?"

In most instances the answer was either "gross neglect or unclean stone." Others were, "poor subgrade, lack of drainage, inefficient construction, working in cold weather," etc. But this fact stood out most prominently: "Crushed stone was condemned for faulty manufacture."

The people with whom I talked were not radical. They were not prejudiced to any particular type. They were consistent men, honest in their endeavor to produce the best possible road.

If unclean stone is the partial cause of dissatisfaction in macadam roads, it is up to us to do something to eliminate this cause.

Tonnage Lost That Might Be Saved

I have also made investigation regarding the tonnage lost to local operations. In Ohio from January 1 to November 1, 1921, 113 miles of various types of macadam road were sold to the State Highway Department. Of this total 38 miles were constructed from local quarries established for the sole purpose of furnishing material for *one* job. I do not know how many of these quarries were abandoned after the one job was completed. No doubt many continued to operate and were a thrust into the heart of the established operator. This condition was caused through our laxity in protecting our own business. We should improve our product which would then insure more substantial macadam roads.

Some of you may howl your heads off when asked to install three or four times your present screening and separating equipment, claiming it will increase costs so as to eliminate crushed stone for road construction. This will not be true; 33 per cent increased tonnage, which is now lost to illegitimate, local competition, would reduce production cost. The additional market accruing immediately after the 100 per cent macadam road is built and time tested would offset any objection from this source.

E. J. Krause, president of N. C. S. A. 1921

Macadam is the type of road Nature intended for us to have. It qualifies in every requirement for road service. It is only necessary for us to take advantage of the great possibilities of macadam. Improve present specifications to the highest point of efficiency. Then opposition will fade away.

The most important requirements in road construction are not given the consideration they deserve. Hardness, smoothness, wearing quality, ability to withstand freezing and thawing are pretty well taken care of by present day specifications. Elasticity and cohesive and adhesive qualities, the most important of all requirements, are absolutely neglected.

A macadam road is elastic. A macadam road will rise and fall with the soft and hard spots in the subgrade and still remain intact. While the so-called hard surface road bridges over the soft spots and in a short time break through.

The rolling surface of macadam, which is often blamed to poor material or construction, is merely the wearing surface following the settling of the sub-grade.

Macadam contains the two elements, most important in maintenance, cohesion and adhesion. A surface of macadam a quarter-of-an-inch thick can be laid over a worn road with assurance that it will stay there and render service. A macadam road surface can be worn to a quarter inch thickness and still it would not be necessary to tear up and take away this last remaining thread of macadam.

The unusual characteristics are absolutely lacking in repairing or resurfacing hard surface roads. Maintenance is accomplished only by destruction and reconstruction. It is costly and financially ridiculous to lay a hard surface road which must be destroyed before it can be maintained.

Imperfect spots will appear in any type of road. They are quickly and cheaply repaired by the cohesive and adhesive macadam. These spots are repaired only by destruction and reconstruction when the road is built of hard surface types.

Must Improve the Product

The weak link in macadam construction is unclean, non-manufactured crushed stone. The good roads movement expects us to correct this difficulty and provide material for construction of roads that Nature intended.

The history of crushed stone production is that of easy going, self-satisfied stone diggers. Contractors and users of crushed stone are accustomed to such loose specifications as to permit local material on practically every job. The crushed stone business must be so perfected and improved upon as to make this local production, unsatisfactory and undesirable, if not altogether impossible.

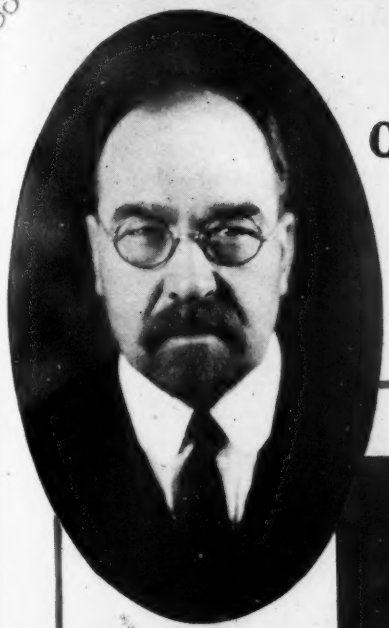
The only reason the user of crushed stone produces his own material is because the production of crushed stone today is so simple, so easy and so inexpensive that any one can do it. Crushed stone is so cheap. Loose specifications have created this condition.

The first thought entering the mind of the contractor is, "Can I buy cheaper than I can produce?" The character and quality of stone are missing. Loose specifications make it possible for anyone to produce crushed stone and has cheated the established crushed stone manufacturer out of thousands of tons which he looked forward to and expected.

Miles of roads have been built from creek-bottom or hillside stone, produced by a "jitney jaw crusher" driven by a threshing engine and screened with a little handmade contraption. It would be impossible to estimate the thousands and thousands of tons lost in this manner.

We have two ways of solving this local production problem. The easiest way is to speed up our operating system, loosen up our specifications, reduce costs and sell crushed stone so cheap that no one would think of producing his own material. This policy does not appeal to me. I consider it undesirable and unbusinesslike. It is nonprogressive. It does not answer the ques-

1922 OFFICERS OF THE NATIONAL CRUSHED STONE ASSOCIATION



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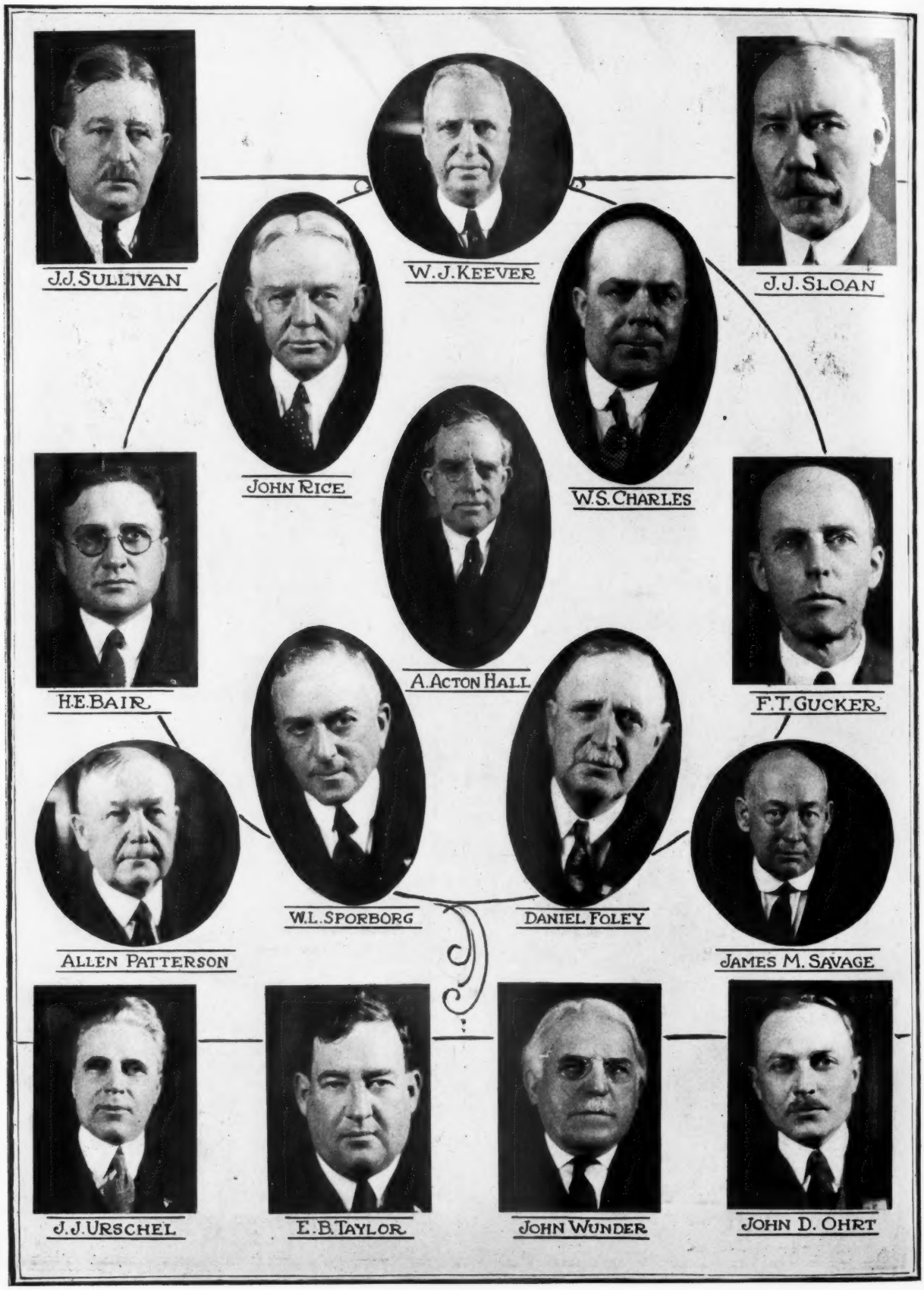

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tion of the 100 per cent perfect macadam road.

The other way is to correct specifications to provide a material that is strictly a manufactured product—one that requires attention and care and which is 100 per cent perfect and clean.

This action would be accepted by everyone and would be one great step forward for the stone industry.

In conversation with an engineer representing a big manufacturer of crushing and screening equipment, I asked: "Why is it that your company and all other companies similarly engaged pay so little attention to the perfection of screens and separators for coarse sized material?" His answer told me more than could be written in a book. "You producers are not interested." That was a curt answer and I have been trying to analyze its full meaning. His answer clearly stated the case. The stone producer has been successful in providing specifications that would meet his operating conditions and permit him to skimp and slide through the wide-open specifications.

We have had orders for No. 2 crushed stone and our superintendent would come to the office and ask if he could slip in a little No. 3 and get away with it because his No. 3 bin was full. Usually the answer has been, "Go ahead, that is good enough." I do not doubt but that this same thing has occurred with every producer. This sort of thing not only permitted but surely invited local production. If we, the established stone producers, could slip through and get away with that sort of stuff, God knows the contractor can do it.

The gravel producers saw the necessity of establishing themselves as manufacturers, and did so by insisting on clean material and have been so successful that there is now almost an universal demand for washed gravel. This automatically eliminated the competition of small local pits.

It is possible, and I believe advisable, for stone producers to create a demand for absolutely clean stone, absolutely properly sized, and by so doing elevate the business from stone diggers to *manufacturers of stone*.

Agricultural Limestone Promotion

We who are interested in agricultural limestone have nearly the same problem. Agricultural workers, experiment stations and universities tell us that the efficiency of agricultural limestone is determined by its 100-mesh content. They also tell us that stone too large to pass through a 10-mesh sieve will never be of any value. While in years to come these large particles may completely dissolve, leaching will carry the calcium solution away just as rapidly as it is made soluble.

We should create a demand for agricultural limestone 100 per cent through a 10-mesh sieve and not less than 50 per cent through a 100-mesh.

Eastern Ohio is full of little insignificant pulverizers producing material that meets with present day specifications and are cheating us out of thousands of tons that rightfully belong to us. If these little pulverizers would deliver a product that is 100 per cent efficient we would not complain. We are fostering and pampering the pup that will grow into the great beast that will ultimately devour us.

The great state of Ohio several years ago enacted a lime and limestone law ostensibly to protect the purchaser. The producers of Ohio insisted that all material passing a ¼-in. ring should be classed as agricultural limestone. They forced recognition of an inferior product that is easy to make and which is now their most dangerous enemy.

When the question of freight rate reduction was before the Public Utilities Commission of Ohio the manufacturers again insisted that this refuse, and unworthy product, be given preferred rates. This was granted and it is now carried on a lower rate than the finely ground product which really and truly is a "godsend" and a money maker for the farmer.

Need More Attention to Salesmanship

Another weak spot in the crushed stone business is our general policy of salesmanship and advertising. We overlook this important phase.

I am inclined to be inquisitive. When I see something new I want to know how it works and what it is made of.

I undertook to find out what a sale is and how it works. I soon discovered I had a real job to find out just what constitutes a sale.

I doubt if I know a great deal about it yet. I found that a sale is composed of several parts each dependent on the other.

I find that a sale is a matter of mental attitude and is born and completed entirely within the mind of the purchaser. A signed order is merely hieroglyphics which act as evidence and which do not amount to much. The salesman is one of two things. He is either a messenger boy carrying this message from purchaser to producer, or he is a pilot using his influence to guide the mental activities of the purchaser in the proper direction.

I fear too many of our sales activities have been of the messenger-boy type. I do not say this with disrespect for the salesman himself, but rather for the general policy that is used by the average producer.

I find a sale to be composed of five parts. First, inspiration; second, desire; third, selection; fourth, decision; fifth, action. Perhaps I should say a sale is composed of six parts. The sixth part, and one of the most important, follows after delivery has been made. Satisfaction and service must be added to consummate a perfect sale.

The first four steps of a sale are taken entirely within the mind of the purchaser and unless outside influence is given through the medium of a subconscious suggestion may run wild on most any course.

The first step in the progress of a sale is "inspiration." Inspiration is the mental activity which gives birth to all things which stand for progress and better living. Inspiration may be cultivated by proper advertising and promotional work. At this point crushed stone salesmanship is sadly lacking. We depend on the organization of inspiration entirely through selfishness, pride, jealousy or experience.

Inspiration for a better road may be brought to a farmer through publicity campaigns. He may aspire for a better road for the convenience it offers from his farm to his market or to his church, his school or his social connections, or he may wait for inspiration to be borne in his mind through personal pride in his home; or he may become jealous of his neighbor who has a good road or by being forced to carry his crop in his granary through a high priced period by not being able to deliver to market.

Good business demands that you cultivate this inspiration for better things and better roads through advertising and publicity campaigns.

The second step, desire, is really intensified inspiration and must follow in the growth of a sale. It is created and grows strong by a repetition of previous events or by observing others, or by the real progressive man in his effort to better general conditions. The same publicity campaign that gives birth to inspiration will promote desire.

The subconscious mind will advance to the third step, selection. Unconsciously this brain begins to observe the different ways of satisfying inspiration and desire. If this brain belongs to a man who is inclined to be thorough and technical he will find from accepted data and experience just what he wants. However, statisticians tell us that 90 per cent of the people of the United States depend on the other 10 per cent to do their thinking and this tendency is increasing because the 10 per cent are willing to do the thinking for the other 90 per cent, thereby swinging them into line with their suggestions. The average purchaser is very susceptible to suggestion and at this point advertising and publicity work are most effective in guiding the mind of the purchaser to your goal.

The fourth step, decision, is the result of selection and is reached after the mind of the purchaser has been satisfied regarding quality and service, either by his own or by the suggestion and direction of advertising and promotional campaigns. If the "order taker" is present, or if convenient methods are furnished, the fifth step, action, is quick and definite. Some of our most successful businesses do not consider the personal order taker necessary. They depend on providing convenient methods in the form of handy, simple order blanks for the transformation of the mental sale into an active sale.

Many sales have been completed in the mind of the purchaser and never reached the producer because convenient methods were not provided.

I believe the messenger-boy or order-taking phase of salesmanship is well taken care of in the crushed-stone business, but I know the element of producing and urging mental sales is sadly deficient.

Advertising Necessary to Modern Selling

I fear the last element of a sale, satisfaction, is somewhat overlooked.

My own 10-year experience as an order taker bears out my conclusion as to salesmanship in the crushed-stone business. The weak spot is not with the salesman himself, but with the general advertising and promotional policies of the industry.

The crushed-stone salesman is sent on the road to sell stone without the assistance of the heavy artillery barrage of advertising from the home office. He drives from place to place calling on commissioners, trustees, contractors and architects, actually asking them if they have "sold themselves" any stone. If they have, he takes the evidence, "the order," and is tickled to think that he has made a sale. If the man he visits has not sold himself the salesman travels on, ever in search of a man who has.

Some of the most useless articles and toys have been produced and marketed in tremendous quantities by systematic, intensive advertising and promotional campaigns which created inspiration, fostered desire, urged selection, accomplished decision and forced action. Then the order taking was easy.

Salesmanship in crushed stone can be placed on this same high plane of efficiency, if the brains of the industry will get busy. This is not possible for a single institution


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CHARLES A. FREIBERG
EDGAR M. LAMKIN
M.B. MILLER
W.B. NEWMAN
CHARLES V. HIGGINS
C.L. SUESSMAN
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W.T. McRAE
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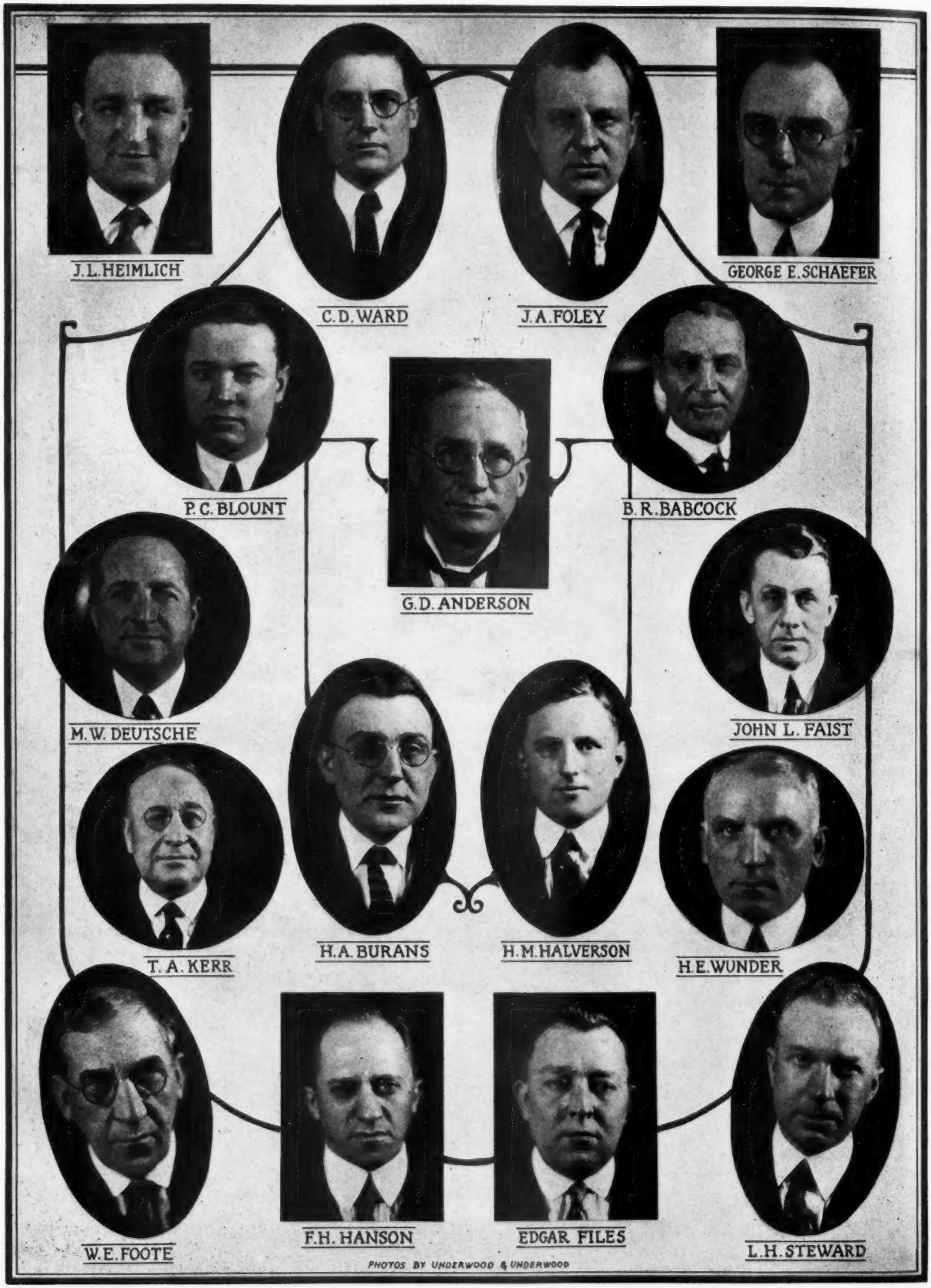
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since we consider it difficult to give the stone of one quarry a personality or a character over the stone of another. It is a co-operative job that should be promoted by the industry rather than by the individual.

Possibilities of Limestone

Other phases of crushed stone need attention. Some of us think about them and some of us do not. We must keep in mind this thought: Limestone is a God-given mineral. Limestone has a million uses and we should develop new markets and new uses for this wonderful and basic mineral.

The history of crushed-stone business does not credit the producer with establishing new uses and new markets, but almost invariably the user has developed the demand and has hunted the producer. I would like to go ahead on this subject with information that has been absorbed the last 10 years, but I feel that the duty of perfecting our industry into the manufacturing class and of improving our salesmanship policy are of sufficient importance that we could confine ourselves to these two and consider the development of new market possibilities next year.

My experience has convinced me this:

Crushed stone has "sold itself."

Crushed stone producers have prospered in spite of themselves rather than because of themselves.

New markets have developed themselves rather than being developed by producers.

Already Demonstrated by Some Crushed-Stone Producers

Mr. Brandon's brilliantly colored picture of what might be done to merchandise crushed-stone in a big way was immediately followed by enthusiastic endorsements of his ideas and by the relation of various instances where just this thing had been done by individual producers.

W. Scott Eames, chairman, general manager of the New Haven Trap Rock Co., New Haven, Conn., said that salesmanship was most important in the successful operation of his company. His company long ago proved the economy of large production and being placed where they simply had to get the business to take care of production, they got it; and at a profit. This company has assiduously cultivated state, county, city and town road officials and contractors, both through personal representatives and by advertising. Monthly letters, of which the following is a sample, are mailed regularly to all these customers and prospective customers.

New Haven Trap Rock Co.
New Haven, Conn., May 11, 1921.

Dear Sir:

The railroads have met present conditions by reducing freight rates on Trap Rock, effective May 12th.

With these greatly reduced rates and with the reduced prices on stone now in effect, Trap Rock can be bought and delivered at a lower cost than for several years.

There is no restriction on the use of freight cars for transporting Crushed Stone. We can now get all cars needed for prompt and regular shipments.

Highways need immediate attention. Place your unemployed citizens to work on your dirt roads.

Application of Trap Rock Screenings will improve your dirt roads 500 per cent. At the present price of Trap Rock Screenings, your cost will be very low.

Our engineers will gladly assist you in your highway problems.

Our plant is now crushing between 55,000 and 60,000 tons a month. Your orders will be taken care of promptly.

At present low prices, all construction work should go on with a great rush.

OUR AIM:

The Best Material.
The Quickest Delivery.
The Most Courteous Service.

Yours very truly,
THE NEW HAVEN TRAP ROCK CO.

Great care is exercised to keep the mailing lists up to date. Blotters with pictures of notable blasts, visits of road officials to the quarry, etc., are also part of the publicity scheme. The sum of $126 a month is spent on these blotters alone. But more important, according to Mr. Eames, is *service* to customers. Employes of the stone company make it their business to trace cars and see that purchasers get prompt and complete deliveries. Mr. Brandon also brought out the desirability of aiding customers to get proper transportation service. He said there were many instances of overcharges in freight bills and suggested that crushed-stone shippers protect their customers by determining the proper charges in advance and notifying the consignee of these charges, or by having the freight bill returned to the shipper for checking.

Mr. Eames said that he had sold 50 per cent of his 1922 production already, that he had frequently bought and resold the entire production of some small plants; and he said advertising and publicity did it!

Norman Hely, manager of the Edward Hely quarry at Cape Girardeau, Mo., advised crushed-stone propaganda work direct on public road officials and influential citizens like bankers, who are the ones that actually determine road-building policies. He gave specific instances of how he had profited by such publicity work.

W. H. Hoagland, president of the Marble Cliff Quarries Co., Columbus, Ohio, who is also a brick manufacturer and a director of the American Face Brick Association, gave the experience of that association in advertising and publicity work. He urged the crushed-stone men to get away from the idea that price is the whole consideration in marketing their product and to consider more that service and quality are at least equally important.

As to the possibility of developing uses for waste products in the crushed-stone industry, Mr. Hoagland cited his own experience in reclaiming millions of tons of dirty screenings, which had been wasted for years, and so refining the product by a washing process that he was able to sell it for glass manufacture and for agricultural limestone. In addition, he gets as a by-product an excellent building sand. (This plant was described in detail in the December 31 issue of Rock Products.)

Chas. A. Freiberg, general manager of the Buffalo Cement Co., Ltd., Buffalo, N. Y., gave an interesting example of the power of advertising and publicity in the crushed-stone industry. He said 800,000 cu. yds. of trap rock was recently specified for a job in Buffalo, which is at least 250 miles from a trap-rock quarry.

John Rice, president of the General Crushed Stone Co., Easton, Penn., threw a note of caution into the discussion by reminding the crushed-stone industry that in the final analysis the use of stone or of a competitive material was an economic problem which could not be definitely solved by propaganda. He said the only kind of propaganda of lasting benefit would be founded on what is best for the public.

A. P. Sandles, secretary of the association, injected words of wisdom in stating that the first step was to thoroughly sell themselves, and then go out and sell the industry in a big way to all comers. Service, he said, must be the keynote of all promotional work.

J. J. Urschel, president of the Woodville Lime Products Co., Toledo, Ohio, distributed copies of a booklet prepared for his company, describing in large boldface text and with colored half tones, "Limestone," and how it is quarried, crushed and marketed—"a constructive force in the development of Industry, Transportation and Commerce."

The convention was promptly sold on the idea of national promotional work and a motion made by Mr. Hoagland and seconded by W. L. Sporborg, president of the Rock-Cut Stone Co., Syracuse, N. Y., was unanimously passed to provide a committee of five which will draw up a definite program and a budget to finance the work of a "research engineer." The matter of standardizing specifications was discussed, but the substance of the discussion was that specifications were more or less of a local issue.

Freight Rates and Transportation

Although no definite action was taken in convention, it was thoroughly demonstrated that opinion in the crushed-stone industry is unanimous that freight rates are local issues and that only trouble can follow specific action on the part of the national association in such local issues.

At a meeting of the executive committee soon after the adjournment of the convention the following policy in regard to the freight rate hearings now in progress before the Interstate Commerce Commission was adopted and transmitted by wire and letter to R. F. Quirk, chief

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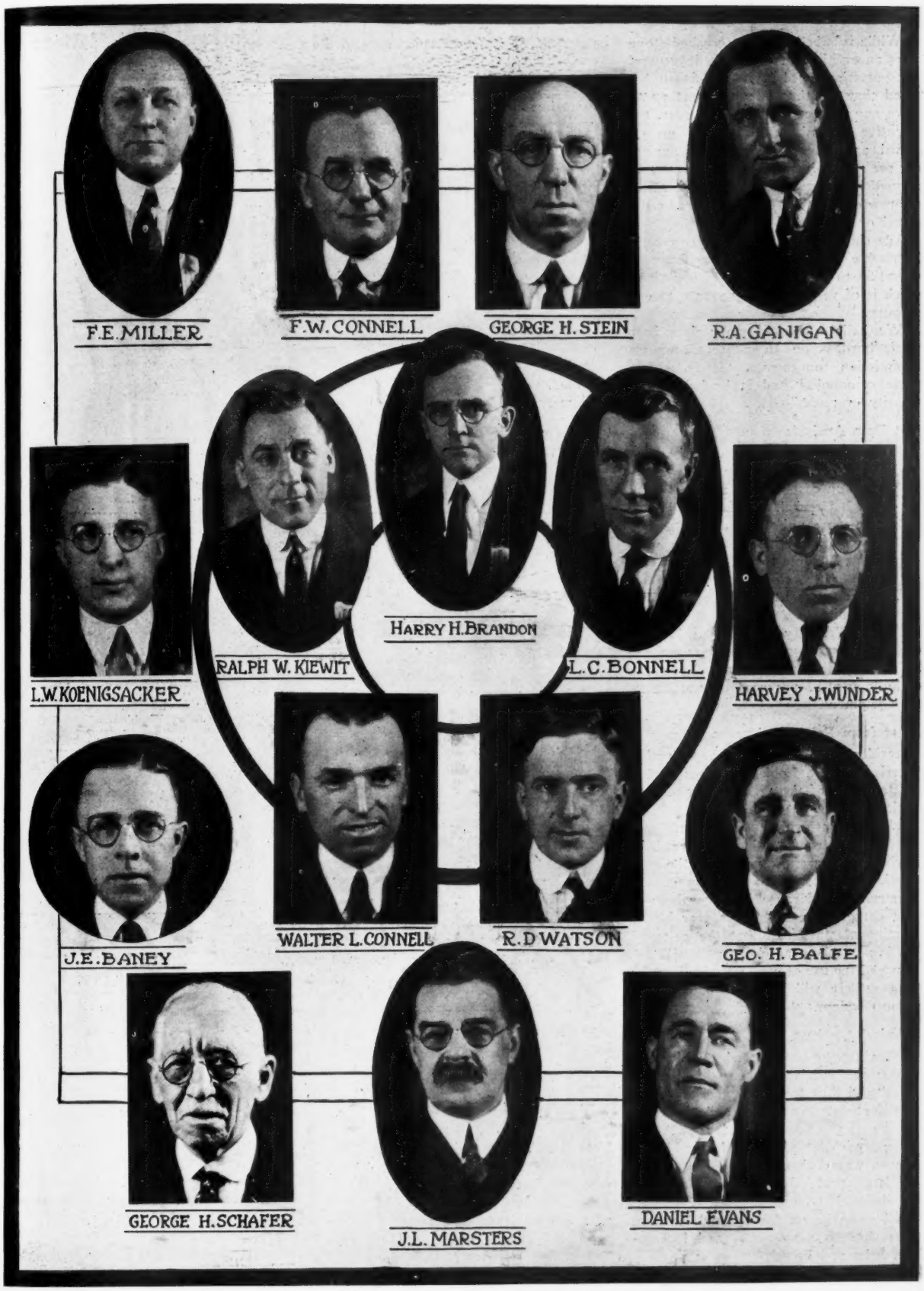


Photos by Underwood & Underwood

engineer of the commission at Washington:

"While it is believed that crushed stone bears an unfair proportion of the general transportation burden, it is further believed that the time is not opportune to make any further protest. However, the executive committee desires to go on record as protesting vigorously against any preference in the way of rates to any competitive material, which may affect or grow out of the hearing, such as sand, gravel or slag.

"We sincerely hope that the Interstate Commerce Commission will give due consideration to this expression of our views which is of very great importance to our industry.

"We believe crushed stone does bear unfair burdens on Interstate Commerce Commission movements. It is a low grade commodity and is loaded to car capacity or more."

Cost Data Analysis

According to the custom established at the 1920 convention there was an interesting session on cost-keeping and cost data, led by J. J. Urschel. Costs reported for 1921 were more uniform than 1920 costs, but the variation still covered the wide range from 70 cents to $1.50 per ton. In connection with cost-keeping John J. Sloan, secretary and treasurer of the Wisconsin Granite Co., Chicago, stated that the U. S. Treasury Department had allowed his company 1¼ cents per ton for depletion of the stone deposits, 5 per cent on buildings, 10 per cent on machinery and equipment.

Letter from President Krause

President E. J. Krause, of the Columbia Quarries Co., St. Louis, Mo., was unable to attend any of the sessions of the convention on account of the death of his daughter. However, an interesting and instructive letter from him was read, in which was a careful analysis of the coal situation and its relation to the quarry industry. Mr. Krause believes there is great danger of a strike this year in the bituminous mines and that the price of coal is now about as cheap as it will be. He urged the use of cars early in the year because there will be a shortage as the season develops.

Technical Sessions

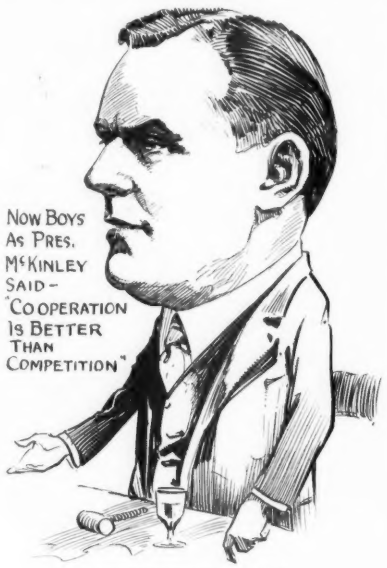
Following the program adopted in 1921 there were special sessions on ballast, agricultural limestone, highway and commercial stone, flux stone, and a special meeting of plant superintendents. At all of these much interesting and valuable experience was exchanged.

A large part of the general sessions was devoted to papers and illustrated talks by experts on powder and blasting, steam shovels, quarry cars and locomotives, belts and belting.

Brownell McGrew, of the Allis-Chalmers Manufacturing Co., read a comprehensive paper on crushing-plant practice in general. This paper and several of the others follow in this and subsequent issues of Rock Products.

Entertainment

The Chicago producers admirably lived up to tradition in the industry in the way of entertainment. The first night a dinner was given to all crushed-stone men



Toastmaster Sandles

attending the convention by President E. J. Krause at the Terrace Garden—one of Chicago's show places. Following the dinner the producers were entertained at a theater party by the Chicago delegation.

The annual banquet of the association on Tuesday night with the inimitable A. P. Sandles as toastmaster was a huge success. Representative road builders and business men from the whole country were guests and speakers.

Officers Elected

W. Scott Eames, general manager of the New Haven Trap Rock Co., New Haven, Conn., was elected president for 1922; F. W. Schmidt, president of the Bound Brook Crushed Stone Co. (and others), Morristown, Penn., was elected first vice-president; W. H. Hoagland, president of the Marble Cliff Quarries Co., Columbus, Ohio, second vice-president; A. J. Sullivan, president of the Inland Crushed Stone Co., Chicago, treasurer, and A. P. Sandles, Columbus, Ohio, secretary.

Next Year's Convention

The convention in 1923 will be held wherever it is decided to have the next American Road Congress—probably Chicago or Cleveland. The program for next year will include more in the way of "experience meetings," with descriptions of plant "kinks" and methods.

Producers Registered at the National Crushed-Stone Convention

C. W. ACKERMANN, Wisconsin Granite Co., Sioux Falls, S. D. H. B. ALLEN, General Crushed Stone Co., Philadelphia, Pa. G. D. ANDERSON, Lone Star Stone Co., Chico, Texas. H. H. ARMSTRONG, Illinois Agricultural Assn., Alton, Ill. G. D. AUORRSON, Lone Star Stone Co., Chico, Texas, Wichita Falls, Texas.

B. R. BABCOCK, The Callanan Road Improvement Co., Albany, N. Y. H. E. BAIR, The France Stone Co., Toledo, Ohio. GEO. H. BALFE, Monon Crushed Stone Co., Monon, Ind. J. E. BANEY, Newton County Stone Co., Kentland, Ind. J. R. BENT, Illinois Agricultural Assn., Chicago, Ill. LESLIE J. BENNETT, Buffalo Cement Co., Buffalo, N. Y. CHAS. BIESANZ, Biesanz Stone Co., Winona, Minn. P. C. BLOUNT, Standard Slag Co., Steubenville, Ohio. L. C. BONNELL, Commonwealth Quarry Co., Summit, N. J. HARRY H. BRANDON, The Ohio Marble Co., Piqua, Ohio. J. I. BROWN, Wallace Stone Co., Bay Port, Mich. THOMAS R. BURNS, Consumers Co., 4430 North Maplewood avenue, Chicago, Ill.

F. G. CARRICO, Carrico Stone & Lumber Co., Rockford, Ill. L. R. CARTWRIGHT, Mid-West Crushed Stone Quarries Co., Indianapolis, Ind. O. P. CHAMBERLAIN, Dolese & Shepard Co., Chicago, Ill. W. S. CHARLES, The Charles Stone Co., Marion, Ill. CLAUDE CLARK, National Crushed Stone Assn., Columbus, Ohio. J. COLLETT, Mid-West Crushed Stone Quarries Co., Ridgeville, Ind. F. W. CONNELL, Indiana Crushed Stone Assn., Indianapolis, Ind. WALTER L. CONNELL, Missouri Quarry Co., 23 South Euclid avenue, St. Louis, Mo.

M. W. DEUTSCHE, Racine Crushed Stone Co., Racine, Wis. F. C. DIEBOLD, Buffalo Part. Curt. Co., Buffalo, N. Y. W. J. DIXON, Kokomo Stone Co., Kokomo, Ind. I. R. DORMAN, American Stone Ballast Co., High Bridge, Kentucky.

W. SCOTT EAMES, New Haven Trap Rock Co., New Haven, Conn. JAS. T. ENGLISH, Hugh-Murphy Const. Co., Omaha, Neb. G. W. ESSERY, Crushed Stone, Ltd., Toronto, Canada. DANIEL EVANS, Daniel Evans Stone Co., Marion, Ohio.

JOHN L. FAIST, Woodville Lime Products Co., Toledo, Ohio, Woodville, Ohio. EDGAR FILES, Bluffton-Lewisburg Stone Co., Lima, Ohio. E. O. FIPPON, National Lime Assn., Washington, D. C. DANIEL FOLEY, Federal Stone Co., Chicago. J. A. FOLEY, Federal Stone Co., 133 West Washington street, Chicago, Ill. J. W. FOLEY, Solvay Process Co., Sibley, Mich. W. E. FOOTE, Wickwire Spencer Steel Corp., Gasport, N. Y. CHAS. A. FREIBERG, Buffalo Cement Co., Ltd., 110 Franklin St., Buffalo, N. Y.

R. A. GANIGAN, Ganigan Lime & Stone Co., 434 Valentine Bldg., Toledo, Ohio. W. S. GEARHART, Illinois Limestone Co., Robinson, Ill. F. T. GLASSCOCK, Hughes Stone Co., Tulsa, Okla. C. E. GRACELY, Gracely Stone Co., St. Paul, Ind. O. M. GRAVES, General Crushed Stone Co., Easton, Pa. DOWNEY M. GRAY, Louisville Cement Co., 315 Guthrie street, Louisville, Ky. F. W. GREAR, Consumers Co., McCook, Ill. R. E. GREELEY, Gracely Stone Co., St. Paul, Ind. C. F. GROTIE, France Stone Co., Toledo, Ohio. GEO. GRUHL, "Canada Crushed Stone," Hamilton, Ontario, Canada. F. T. GUCKER, Dwyer Quarry Co., Philadelphia, Pa.

A. ACTON HALL, Ohio Marble Co., Piqua, Ohio. WM. HAMMERSCHMIDT, Elmhurst & Chicago Stone Co., Lombard, Ill. H. M. HALVERSON, Waukesha Lime and Stone Co., Waukesha, Wis. F. H. HANSON, Belvidere Stone Co., 639 South Main street, Belvidere, Ill. T. L. HEIMLICH, Le Roy Lime and Crushed Stone Corp., Le Roy, N. Y. NORMAN L. HELY, Cape Girardeau, Mo. CHAS. V. HIGGINS, Bound Brook Crushed Stone Co., Bound Brook, N. J. L. B. HODGIN, Kokomo Stone Co., Kokomo, Ind. W. H. HOAGLAND, Marble Cliff Quarries Co., Columbus, Ohio. O. C. HUBBARD, Wisconsin Mineral Aggregates Assn., Milwaukee, Wis. C. M. HUNTER, Parrington Mill Quarry, Parrington Mill, Va.

F. JOHNSON, Prince Johnson Limestone Co., Kansas City, Mo. H. A. JOHNSTON, Ohio Marble Co., Piqua, Ohio. JOHN M. JONES, Wisconsin Granite Co., Berlin, Wis.

H. J. KAUFMAN, The Marble Cliff Quarries Co., Hartman Bldg., Columbus, Ohio. W. J. KEEVER, The Marble Cliff Quarries Co., Columbus, Ohio. N. E. KELB, Ohio and Indiana Stone Co., Greencastle, Ind. A. T. KERR, Brownell Improvement Co., Chicago, Ill. L. B. KERR, Consumers Co., McCook, Ill. RALPH W. KIEWIT, Kiewit Stone Co., First Natl. Bank

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Bldg., Omaha, Neb. L. W. KOENIGSACKER, Linwood Stone and Curb Co., Davenport, Iowa. C. E. KLAUS, Columbia Quarry Co., St. Louis, Missouri.

EDGAR M. LAMKIN, Kelley Island Lime and Trans. Co., 1125 Leader-News Bldg., Cleveland, Ohio. WM. LEADING, Consumers Co., South Bend, Ind.

W. T. McRAE, Crushed Stone, Ltd., Toronto, Canada. C. B. McGRATH, Consumers Co., Chicago, Ill. J. L. MARSTERS, Michigan Limestone and Chem. Co., Rogers City, Mich. F. E. MILLER, Standard Slag Co., Youngstown, Ohio. MISS M. B. MILLER, The Ohio Marble Co., Piqua, Ohio. R. A. MONTGOMERY, Delaware River Quarries Co., Lambertville, N. J. W. A. MOORE, Hughes Stone Co., Tulsa, Okla. A. L. MOSCRIP, Consumers Co., Chicago, Ill. F. C. MURPHY, Brownell Improvement Co., 1220 Chamber of Commerce Bldg., Chicago, Ill.

C. F. NELAND, C. B. Whitmore Co., Lockport, N. Y. M. S. NELAND, C. B. Whitmore Co., Lockport, N. Y. W. T. NEWMAN, General Crushed Stone Co., Easton, Pa. W. B. NEWMAN, Monon Crushed Stone Co., Monon, Ind.

J. D. OHRT, Davis Bros. Stone Co., Lannon, Wis. A. C. O'LAUGHLIN, A. C. O'Laughlin Co., Chicago, Ill. J. O'LAUGHLIN, A. C. O'Laughlin Co., Chicago, Ill.

ALLEN PATTERSON, The Bluffton-Lewisburg Stone Co., Lima, Ohio. F. R. PATTERSON, Bluffton-Lewisburg Stone Co., Lima, Ohio. V. G. POGUE, Spencer Stone Co., Indianapolis, Indiana.

J. F. QUILTY, Superior Stone Co., Chicago. JOHN RICE, General Crushed Stone Co., Easton, Pa. E. G. ROMAN, Consumers Co., Chicago, Ill.

A. P. SANDLES, Secretary National Crushed Stone Assn., Columbus, O. JAMES M. SAVAGE, Buffalo Crushed Stone Co., Buffalo, N. Y. GEO. F. SCHAEFER, General Crushed Stone Co., 205 Cutler Bldg., Rochester, N. Y. GEO. H. SCHAFER, Ft. Madison and Appanoose Stone Co., Ft. Madison, Iowa. R. W. SCHERER, The Western Lime and Cement Co., Milwaukee, Wis. ED. C. SCHLAGETER, Toledo Stone and Glass Sand Co., 320 Terminal Bldg., Toledo, Ohio. F. W. SCHMIDT, JR., Morris County Crushed Stone Co., 17 South street, Morristown, N. J. F. W. SCHMITT, Bound Brook Crushed Stone Co., Morristown, Pa. T. F. SCHROEDER, Linwood Stone and Cement Co., Davenport, Iowa. A. G. SEITZ, Rock Cut Stone Co., Syracuse, N. Y. J. J. SLOAN, Wisconsin Granite Co., Chicago, Ill. A. N. SPENCER, Spencer-Whitlow Co., Columbia, Mo. W. L. SPORBORG, Rock Cut Stone Co., 531 Union Bldg., Syracuse, N. Y. GEO. H. STEIN, Toledo Stone Glass Sand, 321 Terminal Bldg., Toledo, Ohio. L. H. STEWARD, Consumers Co., Chicago, Ill. C. L. SUESSMAN, Ohio Marble Co., Piqua, Ohio. A. J. SULLIVAN, Inland Crushed Stone Co., Chicago, Ill. J. J. SULLIVAN, Dolese & Shepard Co., Chicago, Ill. W. G. SWART, Mesabi Iron Co., Babbitt, Minn.

E. B. TAYLOR, Mid-West Stone Quarry Co., Greencastle, Ind. C. P. TIGGES, Columbia Quarry Co., St. Louis, Mo.

H. F. UHLRICH, Evan-Uhlrich Co., Dubuque, Iowa. K. E. UHLRICH, Evan-Uhlrich Co., Dubuque, Iowa. J. I. URSCHEL, Woodville Lime Products Co., Toledo, Ohio.

H. VANDERWERP, Petoskey Portland Cement Co., Petoskey, Mich. B. T. VAN CAMP, Van Camp Stone Co., Cincinnati, Ohio.

R. N. WALLACE, JR., Wallace Stone Co., Bay Port, Mich. C. D. WARD, The France Quarries Co., New Paris, Ohio. R. D. WATSON, Canada Crushed Stone, Ltd., Dundas, Ontario, Canada. WM. WISKE, Wisconsin Granite Co., Red Granite, Wis. I. W. WORTMAN, North Jersey Quarry Co., Morristown, N. J. H. E. WUNDER, Trap Rock Co., Dresser Junction, Wis. JNO. WUNDER, Trap Rock Co., Minneapolis, Minn. HARVEY J. WUNDER, Trap Rock, Dresser Junction, Wis.

Others Interested in Crushed Stone Production

S. E. ABRAMSON, United States Rubber Co., Chicago. F. S. ALDERMAN, State Engineer, Oklahoma City, Okla. A. R. AMOS, Easton Car & Constr. Co., Easton, Pa. WM. A. ANDERSON, Hercules Powder Co., Buffalo, N. Y. W. J. AUSTIN, Hercules Powder Co., Chicago, Ill.

D. D. BARNES, Smith Engineering Works, Chicago. EUGENE C. BAUER, American Manganese Steel Co., Chicago. L. B. BIRCKHEAD, Buckeye Co., Milwaukee, Wis. J. S. BOND, Worthington Pump & Mach. Co., Cudahy, Milwaukee, Wis. T. D. BOWER, Scientific Boiler and Chem. Wks., Chicago, Ill. F. C. BOWMAN, Consulting Engineer, Wichita Falls, Texas. F. M. BUEHLER, Eagle Point Iron Works, Dubuque, Iowa. C. A. BURGESS, T. L. Smith Co., Milwaukee, Wis. E. J. BURNELL, Link-Belt Co., 49 Federal street, Boston, Mass.

B. E. CLARK, Comm. of Highways, Capitol Bldg., Oklahoma City, Okla.

W. F. GAINTY, Hercules Powder Co., Chicago, Ill. FRED A. GILL, Gill-Well Drill Sharpening Mach., Lebanon, Pa. B. Z. GOOD, Loomis Machine Co., Tiffin, Ohio. N. S. GREENSFELDER, Hercules Powder Co., Wilmington, Del. J. H. GREGORY, Barber-Greene Co., Aurora, Ill.

BEN HAISLIP, Traylor Eng. and Mfg. Co., Chicago, Ill. H. C. HAMPTON, Jno. A. Roeblings Sons Co., Chicago, Ill. E. E. HANDY, Du Pont Powder Co., Wilmington, Del. HARRY G. HARTON, Du Pont Powder Co., Chicago, Ill. E. W. HAWLEY, General Explosives Co., Chicago, Ill. JNO. J. HEFFERNAN, Grasselli Powder Co., Fisher Bldg., Chicago, Ill. C. K. HENDERSON, Manhattan Rubber Co., Passaic, N. J. L. J. HEWES, Traylor Eng. and Mfg. Co., Chicago, Ill. J. H. HOCK, Taylor-Wharton I. & S. Co., 208 South La Salle street, Chicago, Ill. GEO. E. HUNTER, Union Enpl. Co., Pittsburgh, Pa.

J. H. JEWETT, R. & J. Dick Co., Inc., Passaic, N. J. H. A. JOHANN, Frog Switch and Mfg. Co., St. Louis, Mo. J. M. JOHNSON, Allis-Chalmers Mfg. Co., 2306 North Lawndale avenue, Chicago, Ill.

M. S. KINCAID, Grasselli Powder Co., Chicago, Ill. L. Z. LAWRENCE, E. I. Du Pont de Nemours & Co., Wilmington, Del.

EARL A. LERNER, American Manganese Steel Co., Chicago Heights, Ill. S. G. LLEWELLYN, Taylor-Wharton I. & S. Co., 208 South La Salle street, Chicago, Ill. G. S. LINCOLN, Allis-Chalmers Mfg. Co., Milwaukee, Wis. A. F. LUDER, Bunting Hardware Co., Kansas City, Mo. H. F. McDERMOTT, Taylor Wharton I. & S. Co., 208 South La Salle street, Chicago. BROWNELL McGREW, Allis-Chalmers Mfg. Co., Milwaukee, Wis.

J. D. POORMAN, Trojan Powder Co., Allentown, Pa., Chicago, Ill. J. J. PLEAS, Producers Building and Material Co., Chicago, Ill. C. POWELL, Bunting Hardware Co., Kansas City, Mo.

JNO. W. ROOKS, Contractors, McAlester, Okla. R. R. RANEY, New Paris Mirror, New Paris, Ohio. J. L. ROSE, Sanderson Cyclone Drill Co., Orrville, Ohio. S. R. RUSSELL, Du Pont Powder Co., Wilmington, Del.

E. L. SANBORN, Worthington Pump & Mchy. Corp., 820 Old Colony Bldg., Chicago, Ill. H. C. SHIELDS, R. & J. Dick Co., Inc., Chicago, Ill. A. J. SHOEMAKER, General Explosives Co., Chicago. J. L. SCHAFER, Lucas County Maintenance Dept., Toledo, Ohio. C. A. SPENSLEY, Du Pont Powder Co., Chicago, Ill.

WILLIAM WARR, The Manhattan Rubber Mfg. Co., 61 Willett street, Passaic, N. J. H. J. WEMETT, R. & J. Dick Co., Inc., Chicago, Ill. O. A. WHITE, Fate-Root-Heath Co., Plymouth, Ohio. H. E. WHITNEY, Burke & Whitney, Lockport, N. Y. J. F. WISHART, Du Pont Powder Co., Chicago.

Let's Go—to New Orleans!

THE above is the invitation of the National Association of Sand and Gravel Producers for its sixth annual convention at the Hotel Grunewald, New Orleans, on February 1 to 3. Aside from the many pleasures to be had in that delightful city, there is also financial profits accruing—J. C. Shiely, St. Paul contractor, said he found a $50,000 idea at the last convention, and you stand an equal chance this year.

The program includes, besides a warm welcome from Mayor McShane, an address by Everett Sanders, Congressman from Fifth Indiana District, on "The Transportation Problem and Its Relation to the Sand and Gravel Industry." Mr. Sanders has been on the Interstate and Foreign Commerce Committee having jurisdiction of railroad legislation during the past three years when the transportation question has been at the forefront. He will give some very interesting facts relative to present and future transportation problems. Thomas H. MacDonald, Chief, Bureau of Public Roads, will speak on "The Immediate Future of Highway Building," and give a brief review of the investigation of the gravel road which has been conducted by his Bureau during the past year.

The subject of George Kilian, secretary, Dixie Portland Cement Co., Chattanooga, is "To What Extent Does Cost Accounting Pay?" Mr. Kilian was chairman of the committee which designed the uniform cost accounting system adopted by the Portland Cement Association. His address is sure to be productive of great benefit. Edmund Shaw, chief engineer, Allen Cone Co., El Paso, will detail the principles of water classification of sand and the design of sand settlers. His discussion is sure to prove both interesting and profitable to all producers, particularly if you have followed his articles in ROCK PRODUCTS of recent date.

Annual Meeting of Ohio Valley Association

AT the annual meeting of the Ohio Valley Sand and Gravel Association, held at the Windsor Hotel, New Martinsville, W. Va., on December 20, the following officers were elected for 1922: President, W. H. Merrill, Charleston, S. C.; vice-president, W. C. Fisher, River Sand Co. (Steubenville, Ohio), Pittsburgh; secretary-treasurer, A. P. Turley, Marietta Sand Co., Marietta, Ohio, re-elected. William E. Shivers, New Martinsville Sand Co., New Martinsville, W. Va., was appointed to assist Captain Turley.

Following the regular meeting a banquet was served. Among those present were: W. F. Ewell, East Liverpool Sand Co., East Liverpool, Ohio; Charles Corliss, New Martinsville Sand Co., New Martinsville, W. Va.; P. B. Hickson, Ohio Valley Sand and Gravel Co., Shadyville, Ohio; G. C. Ross, Parkersburg Sand Co., Parkersburg, W. Va.; Charles Donley, Pittsburgh; A. E. Froschel, Wheeling Sand and Gravel Co., Wheeling, W. Va.; National Secretary E. Guy Sutton, Washington, D. C.; W. O. McCluskey, Jr., assistant state engineer, Wheeling, W. Va.

Lime on Sandy Soil

WE HAVE seen light lands covered with sorrel as sour as any soil could be, says *Rural New Yorker*. Lime will keep such soils in two ways. It will correct the acidity, and also help the mechanical condition. It does this on much the same principle that lime makes mortar when mixed with sand. The lime binds the soil together, and makes it more compact, so that it will hold water. On a clay soil the lime will have exactly the opposite effect.

American Good Roads Congress for Progress and Permanency

Condemns Politics in Highway Departments—Demands Price Reductions in Materials and Construction—Blames Delays to High Freight Rates

THE twelfth American Good Roads Congress, comprising the nineteenth annual convention of the American Good Road Builders' Association and the thirteenth National Good Roads Show, held at the Coliseum, Chicago, on January 16 to 20, was from every standpoint the most successful congress ever held by these bodies.

On Monday evening the Good Roads Show was opened to the public, of which more will be said later.

In his opening address President Bowlby declared that highway construction constitutes one of the five leading industries in our country. He prophesied that the association will one day become the most potent influence in highway development in the United States, if not in the world.

"I believe," said he, "that there should be more effective co-operation by the organization with the U. S. Bureau of Public Roads, the state highway departments and their official organization, the American Association of Highway Officials. It shall be my purpose to appoint a committee to work out these problems. I would also like to see the organization brought into greater harmony with public officials, contractors, manufacturers and material men to the end that we may co-ordinate and develop the American system into the best in the world."

Chief Engineer J. H. Mullen of the Minnesota Highway Department presided over the afternoon session. "Bituminous Foundations," by Hugh W. Skidmore, Chicago Paving Laboratory, was the first paper, followed by "Utilization of Local Materials for Mineral Aggregates," by W. A. Welch, general manager and chief engineer of the Palisades Interstate Park Commission, New York. Major Welch's paper on this topic was apparently based on the trap rock common to the Palisades, which is the best aggregate in the world, and therefore reflected most unusual conditions.

Other papers were "Asphalt Specifications," by L. M. Law, chief chemist, New Orleans Refining Co., New Orleans; "Specifications for Mineral Aggregates," Roy M. Green, Western Laboratories, Lincoln, Neb. Mr. Green's paper will be published in an early issue of ROCK PRODUCTS.

Chief Engineer C. M. Upham of the North Carolina Highway Department presided at the Wednesday morning session when Thomas H. MacDonald, chief of the U. S. Bureau of Public Roads, declared that at this time, as in private business, the government must strike a balance sheet. A balance sheet must be established in which is set up the funds available, the economic situation and prices and costs, against deferred highway improvements, returns from investments and the need for easy and cheap transportation facilities. While the present depression is not wholly due to the great increase in freight rates, these rates are a large factor, declared Mr. MacDonald.

In concluding, he cited comparative figures showing that during 1910-21 the potential number of motor vehicles demanding highway service increased more than 1800 per cent. The actual expenditures for highway construction and maintenance increased about 400 per cent. During 1910-14 motor vehicles increased more than 100 per cent; highway expenditures about 140 per cent. During 1914-21 motor vehicles increased about 700 per cent, highway expenditures about 200 per cent. But even these figures do not truly represent the differential between the highway service and the actual production.

Other papers were "Development of Small Stream Valleys Into Traffic Routes," by Jay Donner, chief engineer of the Bronx Parkway Commission, New York; "Co-operation of All Parties Interested in the Construction of a Modern Road," by William Ord, manager of paving department, Lakewood Engineering Co., Cleveland; "Uniform Legislation as Affecting Highway Traffic and Highway Transport," by D. C. Fenner, manager Public Works Department of the International Motor Co., New York.

Wednesday afternoon's session was given over to papers on highway finance by Prof. Arthur H. Blanchard, professor of highway engineering and highway transport, University of Michigan; C. M. Babcock, commissioner of the Minnesota Highway Department; A. R. Hirst, chief engineer of the Wisconsin Highway Commission; C. M. Upham, chief engineer of the North Carolina Highway Department. Prevost Hubbard, chemical engineer of the Asphalt Association, New York, read a very interesting paper on "A Simple Graphic Method of Proportioning Sands for Sheet Asphalt Mixtures." This paper will appear in an early issue of ROCK PRODUCTS.

At Thursday's session, Chairman Hirst presiding, the following papers were presented:

"The Selection of Mineral Aggregate for a Portland Cement Concrete Roads," D. A. Abrams, director, Structural Materials Research Laboratory, Lewis Institute, Chicago; "Inspection and Control of Materials for Concrete Roads," R. W. Crum, state testing engineer, Iowa Highway Commission; "Importance of Surface Finish and Methods of Control," H. E. Breed, consulting engineer, New York City; "Single Track Concrete Roads for the Average County," P. C. McArdle, county highway superintendent, Vermilion County, Illinois; "Pavement Widths for Highway Serving Large Cities," William F. Cavanaugh, county highway commissioner, Milwaukee, Wis. Chairman Blanchard presided at the afternoon session. The following papers were read: "Truck Overloading, Its Relations to Road Construction and Maintenance," J. G. McKay, professor of Economics, University of Wisconsin; "The Illinois Experimental Road," Clifford Older, chief highway engineer, Department of Public Works, Illinois; "Highway Research," W. K. Hatt, Professor of Engineering, Purdue University; "Highway Researches and What the Results Indicate," A. T. Goldbeck, chief, Division of Tests, U. S. Bureau of Public Roads.

On Friday morning, with H. G. Shirley in the chair, the following papers were read: "Construction and Maintenance of Earth Roads," George E. Johnson, Secretary of Public Works, Lincoln, Neb.; "A Systematic Study of Gravel for Road Purposes," Wallace F. Purrington, chemist and testing engineer, New Hampshire Highway Department; "Cost Keeping on Highway Construction," A. R. Losh, assistant chief of construction, U. S. Bureau of Roads; "The Highway Contractor's Problems," H. H. Wilson, Winston & Co. At the concluding session in the afternoon resolutions were passed condemning political interference with highway departments; using highways as speedways; also, that contractors and materials men so adjust their prices that no further delay in construction programs can be laid to high costs; the elimination of grade crossings and billboards on main traveled highways, and making the greatest road construction campaign in 1922 the history of the highways.

The Good Roads Show

WITH the entire first floor and galleries of the Coliseum crowded by road-building equipment and materials, and even overflowing into the Annex and two adjoining buildings, the thirteenth annual National Good Roads Show gave ample evidence of the largest representation of highway products ever before displayed. The attendance both day and night was most gratifying and the visitors evinced much interest in the exhibits. The Show also made a strong appeal to the visiting highway engineers, who spent much time between sessions in the exhibit hall. It has been said that more than $2,000,000 worth of orders were taken during the week for road-building machinery alone.

Some fear has been expressed that unless the city of Chicago can provide larger accommodations for the 1923 Show, it will be compelled to go elsewhere. It is said that the managers of the Coliseum are negotiating for adjoining property to extend the building northward.

There was a well-attended smoker on Wednesday evening for the entertainment of the guests of the exhibitors' association.

Among the exhibitors whose products are of direct interest to the readers of ROCK PRODUCTS were the following:

Acme Road Machinery Co., Frankfort, N. Y.; Allis-Chalmers Mfg. Co., Milwaukee, Wis.; American Casting Co., Birmingham, Ala.; American Cement Machinery Co., Keokuk, Ia.; American Gas Accumulator Co., Elizabeth, N. J.; American Highway Educational Bureau, Washington, D. C.; American Refractories Co., Pittsburgh, Pa.; American Steel & Wire Co., Chicago; Atterbury Motor Car Co., Buffalo, N. Y.; Austin Machinery Corporation, Chicago; Austin-Western Road Machinery Co., Chicago; Autocar Co., Ardmore, Pa.; Avery Co., Peoria, Ill.

Baldwin Chain & Mfg. Co., Worcester, Mass.; Ball Engine Co., Erie, Pa.; Barber-Greene Co., Aurora, Ill.; Barnes Mfg. Co., Mansfield, Ohio; Beach Mfg. Co., Charlotte, Mich.; Black & Decker Mfg. Co., Baltimore, Md.; Blaw-Knox Co., Pittsburgh, Pa.; Brown Hoisting Machinery Co., Cleveland, Ohio; Bucyrus Co., South Milwaukee, Wis.; Buda Co., Harvey, Ill.; Buff & Buff Co., Boston, Mass.; Burch Plow Works, Crestline, Ohio; Byers Machine Co., The, Ravenna, Ohio.

Carbic Mfg. Co., Chicago; Chain Belt Co., Milwaukee, Wis.; Clark Tructractor Co., Buchanan, Mich.; Columbian Steel Tank Co., Kansas City, Mo.; Concrete Steel Co., New York, N. Y.; Conneaut Shovel Co., Conneaut, Ohio; Conway Co., R. F., Chicago.

Domestic Engine & Pump Co., Shippensburg, Pa.

East Iron & Machine Co., Lima, Ohio; Easton Car & Construction Co., New York, N. Y.; Electric Wheel Co., Quincy, Ill.; Electrical & Specialty Supply Co., Chicago; Elgin Sales Corp., Chicago; Equipment Corporation of America, Chicago; Erie Steel Construction Co., Erie, Pa.; Eugol Motor Truck Co., Chicago, Ill.

Fate-Root-Heath Co., Plymouth, Ohio; Foote-Concrete Machinery Co., Chicago; Four Wheel Drive Auto Co., Clintonville, Wis.

Galion Iron Works & Mfg. Co., Galion, Ohio; General Motors Truck Co., Chicago; Good Roads Machinery Co., Kennett Square, Pa.; Green, L. P., Chicago.

Hadfield-Penfield Steel Co., Bucyrus, Ohio; Handy Sack Baler Co., Cedar Rapids, Iowa; Heil Co., Milwaukee, Wis.; Heltzel Steel Form & Iron Co., Warren, Ohio; Highway Trailer Co., Edgerton, Wis.; Holt Mfg. Co., Peoria, Ill.; Hough Mechanical Hoist Co., Chicago; Hvass & Co., Inc., Chas., New York; Hyatt Roller Bearing Co., New York.

Indiana Truck Corp., Marion, Ind.; Industrial Works, Bay City, Mich.; International Motor Co., New York; International Steel Tie Co., Cleveland, Ohio.

Jennings Automatic Dump Body, Inc., Roanoke, Va.

Kentucky Rock Asphalt Co., Louisville, Ky.; Keuffel & Esser Co., Hoboken, N. J.; Keystone Driller Co., Beaver Falls, Pa.; Kissel Motor Car Co., Hartford, Wis.; Koehring Co., Milwaukee, Wis.; Koppel Industrial Car & Equipment Co., Koppel, Pa.

Lakewood Engineering Co., Cleveland, Ohio; Lange, Walter W., Milwaukee, Wis.; Larco Wrench & Mfg. Corp., Chicago; Lee Trailer & Body Co., Chicago; Le Roi Co., Milwaukee, Wis.; Lewis Mfg. Co., F. J., Chicago; Littleford Bros., Cincinnati, Ohio; Locomotive Crane Co. of America, Champaign, Ill.

Martin-Parry Corp., Chicago; Metal Forms Corporation, Milwaukee, Wis.; Milwaukee Locomotive Mfg. Co., Milwaukee, Wis.; Monarch Tractors, Inc., Watertown, Wis.; Morand Cushion Wheel Co., Chicago.

Northwest Engineering Co., Chicago; Novo Engine Co., Lansing, Mich.

Osgood Co., Marion, Ohio; Oshkosh Mfg. Co., Oshkosh, Wis.; Owen Bucket Co., Cleveland, Ohio.

Parker Motor Truck Co., Milwaukee, Wis.; Pawling & Harnischfeger Co., Milwaukee, Wis.

Ransome Concrete Machinery Co., Dunellen, N. J.; Reo Motor Car Co., Lansing, Mich.; Republic Truck Sales Corp., Alma, Mich.; Rogers Tractor & Trailer Co., Albion, Pa.

Sauerman Bros., Chicago; Sasgen Derrick Co., Chicago; Schacht Motor Truck Co., G. A., Cincinnati, Ohio; Sewell Cushion Wheel Co., Detroit, Mich.; Shaw-Enochs Tractor Co., Minneapolis, Minn.; Smith Co., T. L., Milwaukee, Wis.; Smith Engineering Works, Milwaukee, Wis.; Stroud & Co., Omaha, Neb.

Thew Shovel Co., Lorain, Ohio; Titan Truck Co., Milwaukee, Wis.; Truscon Steel Co., Youngstown, Ohio.

United States Bureau of Public Roads, Washington, D. C.

Van Dorn Iron Works, Cleveland, Ohio.

Wallis Boiler Co., The, Chicago; Warner Trailers Co., Beloit, Wis.; Waukesha Motor Co., Waukesha, Wis.; Western Wheeled Scraper Co., Aurora, Ill.; Whitcomb Co., Geo. D., Rochelle, Ill.; White Co., The, Cleveland, Ohio; Wilson Machinery Co., F. W., Chicago; Wisconsin Motor Mfg. Co., Milwaukee, Wis.; Wood Hydraulic Hoist & Body Co., Detroit, Mich.; Wyoming Shovel Works, Wyoming, Pa.

Program for Sand-Lime Brick Association Convention

THE eighteenth annual convention of the Sand-Lime Brick Association will be held at Dayton, Ohio, on February 1 and 2, at the Hotel Miami. The program for the two days is as follows:

MORNING SESSION, FEBRUARY 1—10 O'CLOCK—MIAMI HOTEL ROOF

Enrollment.
Report of president, secretary and treasurer.
Appointment of Committees—Audit, Nomination, Resolutions.

AFTERNOON SESSION—1:30 O'CLOCK—FACTORY OFFICE OF CRUME BRICK CO.

Results Obtained with New Devices Installed at Crume Brick Co.—Paper by W. H. Crume, Crume Brick Co., Dayton, O.

Operating Costs with Continuous Automatic Equipment.—Paper by D. C. Kiser, Crume Brick Co., Dayton, O.

Operating Costs with Continuous Automatic Equipment.—Paper by Irwin G. Toepfer, Acme Brick Co., Milwaukee, Wis.

Operating Costs Wet Pan Installation—(Picture showing plant in operation).—Paper by Henry O. Joseph, Grand Brick Co., Grand Rapids, Mich.

Handling Sand by Trucks.—Paper by J. Morley Zander, Saginaw Brick Co., Saginaw, Mich.

MORNING SESSION, FEBRUARY 2—10 O'CLOCK—AT MIAMI HOTEL ROOF

Report of Committee on Tests and Standards.—W. H. Crume, Dayton, O., and Clyde C. Dalley, National Brick Co., Washington, D. C.

Improved Continuous Operation of Pot Lime Kiln.—Paper by C. L. North, Sheehan North Co., El Paso, Tex.

Lime Mortar in Relation to the Use of Sand-Lime Brick.—Paper by R. P. Brow, National Lime Association, Washington, D. C.

Patented Process Hydrating Lime.—Paper by H. W. Charlton, Eastern Potash Corp., New York City.

Burning and Making of Lime Suitable for Small Size Brick Plants.—Paper by Warren E. Emley, U. S. Bureau of Standards, Washington, D. C.

AFTERNOON SESSION—1:30 O'CLOCK

Unfinished business.
Report of committees.
Election of officers.

Round Table Discussion—Conducted by W. K. Squire, Paragon Plaster Co., Syracuse, N. Y.

New Officers Indiana Crushed Stone Association

AT THE annual meeting of the Indiana Crushed Stone Association, which was held in conjunction with the National Crushed Stone Association in Chicago, Jan. 17, the following officers were elected for 1922:

President, Charles N. Hodgin, Kokomo Stone Co., Kokomo, Ind.; vice-president, Bernard L. McNulty, Lehigh Lime Co., Chicago; treasurer, V. G. Pogue, Spencer Stone Co., Indianapolis, Ind., and secretary, F. W. Connell, Indianapolis, Ind.

The executive committee consists of E. B. Taylor, Mid-West Stone Quarries Co., Greencastle, Ind., chairman; L. H. Hamblitz, France Stone Co., Toledo, Ohio; Geo. Bolfe, Monon Stone Co., Monon, Ind.; J. E. Bowen, Newton Counton Stone Co., Kentland, Ind., and V. G. Pogue, Spencer Stone Co., Indianapolis, Ind.

Mississippi Highway Officials Demand Lower Cement Prices

JUSTIFIABLY or not, the state highway officials of the Middle West have, according to the Chicago *Tribune* of January 21, "declared a practical boycott" on cement at present prices. At the fourteenth annual meeting of the Mississippi Valley conference of state highway departments on January 20 a resolution was adopted by the conference officials of Illinois, Iowa, Kansas, Michigan, Minnesota, Missouri, South Dakota and Wisconsin declaring that cement companies have failed to reduce prices of their product in accord with prevailing economic conditions.

They accused the companies of capitalizing on the public need for road material and pledged themselves to make contracts involving the use of cement only in cases where the work cannot be postponed. This attitude will continue, they declare, until cement prices are "in harmony with reduced prices now in effect for all basic commodities."

The conference further recommended that states in which the laws and circumstances permit take steps immediately to investigate the possibilities of erecting and operating cement mills to supply highway construction needs.

Crushing Plant Engineering*

Entering a New Phase—Day of Pioneering Without Adequate Data Is Over

By Brownell McGrew
Engineer, Allis-Chalmers Mfg. Co., Chicago, Ill.

THE PROCESS of producing crushed stone and putting it on the market may be divided roughly into three main groups of activity—quarrying, crushing and selling.

Andrew Carnegie, when asked which of the three economic factors—capital, labor, or materials—he considered the most important, answered, "Which is the most important leg of a three-legged stool?" Mr. Carnegie's remark applies very aptly to the three divisions of crushed-stone production. If one leg is short you have at the best a wobbly stool, and a two-legged stool is no stool at all.

Between the primary operation of quarrying and the final one of marketing stands the crushing plant—the neck of the bottle through which the commodity must be poured to prepare it for the market. It seems to me, therefore, that a brief discussion of the principles of crushing plant engineering cannot but be of interest to you all, because upon the forethought and judgment that have gone into the crushing plant's original design, or its subsequent remodeling, depend in a very large measure the success of your operation as a whole.

There is probably no branch of industrial engineering in which the individual judgment and "common sense" of the engineer are of greater importance than in the crushed-stone industry.

Naturally, there is considerable difference of opinion as to what constitutes "common sense"; it is not surprising, therefore, that there is a considerable difference of opinion as to what constitutes good crushing plant engineering, particularly in view of the fact that there is no fixed standard or criterion by which to compare one crushing plant with another.

Furthermore, crushing practice has gone forward by leaps and bounds in the past two decades, and what was good engineering in the light of yesterday's experience may not be good engineering in the light of our present-day knowledge.

There are, however, a few sound basic principles upon which all successful engineering must be based, a few standards that any efficient plant must measure up to.

Effectiveness of Operation

The first of these—*EFFECTIVENESS*—is the most important measuring rod that can be applied to an industrial plant of any kind.

Will the plant do what it was designed to do?

As regards the crushing plant effectiveness bears directly upon capacity for one thing, and here we have one of the greatest stumbling blocks for the unwary designer.

Adequate capacity must be provided for throughout the plant; in the main breaker, the secondaries, screens, elevators, hoists.

Not only must the plant be capable of crushing a certain tonnage in a given time, but it must also be capable of reducing the stone to marketable sizes and properly separating, grading, and perhaps remixing certain sizes.

The demand for clean stone, properly graded, is becoming more and more insistent, and the wise operator is putting his plant in shape to meet this demand.

Likewise there is an ever-increasing demand for the smaller sizes of crushed stone for reinforced concrete work, highway binder, etc., and the modern commercial plant, to be fully effective, must be prepared to deliver these grades in large quantities.

Plant Capacity—Primary Breaker

Ordinarily when plant capacity is mentioned the mind jumps instantly to a consideration of the proper size of primary breaker, for there is probably no one factor in a crushing plant that has so far reaching an effect, from a dollars and cents standpoint, as this machine.

Aside from the element of capacity the size and type of primary crusher influences directly practically every unit in the plant that follows it, and frequently the disposition of these units.

Looking at it from the plant side the most economical breaker is the one that will deliver to it the smallest product—and a product that is relatively free from slabs and fines. Looking at it from the quarry side the most effective crusher is the one that will cut to a minimum the cost of drilling and shooting.

Herein lies the chief advantage of the big receiving opening.

Mr. Edison's line of reasoning when he first developed the Edison roll crusher was as follows: "A pound of coal and a pound of dynamite have approximately the same potential energy value, but a pound of dynamite costs from eighty to one hundred times as much as a pound of coal; therefore why not do as much of the work as possible with coal rather than with dynamite?"

The development of the large crusher and the introduction of the steam shovel into quarry operation are without doubt the two most important improvements that have been made since the inception of the industry, and it is safe to say that development along these lines has not yet reached its limit.

On the other hand, it should be remembered that for any given set of conditions there is an economical limit to the size of primary crushers.

Figuratively speaking, one must stand in the middle of the proposition and look both ways.

On the one side we have the very enticing possibility of making a substantial cut in the cost of quarrying; on the other we are checked by the factors of first cost, power, upkeep, ratio of reduction, etc.

Effectiveness of Location

The relative effectiveness of a plant will also depend to a very considerable extent upon its location.

Primarily this involves the problem of quarry transportation, of getting the stone from pit to plant as cheaply as possible.

Second only to this in importance is the problem of getting the stone away from the plant and of providing ample storage room for both empty and loaded cars.

It is frequently the case that a location which is advantageous from a standpoint of transportation in the quarry will complicate the handling of the railroad cars, even to the extent of necessitating the use of a locomotive to do the loading.

You will, of course, wish to avoid this when possible; nevertheless it should be remembered that the ton-mile cost of handling the finished product in railroad cars will be very much lower than that of making long hauls in the quarry.

Furthermore, in large commercial operations the locomotive is sometimes necessary—or at least very expeditious—for loading mixed sizes and cutting out required types and capacities of cars needed to fill certain orders.

Continuity of Operation

Effectiveness is also the measure of a plant's ability to operate continuously throughout the season with a minimum of breakdowns or delays from other causes.

Rugged and dependable machinery is the best safeguard against breakdown, and a simple layout, comprising the absolute minimum number of units necessary to do

*Paper read at 1922 Annual Convention of the National Crushed Stone Association.

the work is the best safeguard against minor delays and accidents.

A principle of crushing plant design second only in importance to effectiveness is that flexibility which, in its broadest sense, is the measure of the plant's ability to meet a varying market demand.

Those of you who are operating plants which do not have this element of flexibility have probably experienced more than once the necessity of turning down orders for certain grades of material, while at the same time you were overstocked on other sizes.

I have mentioned before the increasing demand for the smaller sizes of stone, and the necessity of equipping the plant to take care of this demand. I do not propose in this paper to discuss the various types of fine crushers and their relative merits, but I do wish to lay special emphasis upon their value to the operator.

Good Crusher Practice—Closed Circuits

Fine crushing machines should be so located in the plant that any of the coarser sizes which may be temporarily unmarketable may be readily returned to them for re-crushing.

The value of the closed circuit principle in crushing plant design is so well known, and the principle is so generally adhered to that it would scarcely seem necessary to mention it here. Nevertheless there are still a rather surprising number of plants in operation which are wide open on the finishing end.

This is most frequently found to be the case in plants where the product of the secondary crushers is returned to the scalping screens for re-separation, making a closed circuit at this point and sending on to the finishing screens all material under the maximum size produced.

This is good practice in a straight ballast plant, but is hardly excusable in a general commercial mill as all adjustments in product must be made by changing sections in the scalping screens—whereas in the closed circuit plant changes in product can be made while the mill is in full operation.

Stock Piling

Most of you, no doubt, are equipped in some way or other to stock such grades as may be unsalable at the time they are made.

The stock pile is coming to be a very necessary adjunct to the commercial crushing plant as there seems to be no other method of adequately taking care of a fluctuating market.

It is but natural, though, that the quarryman should not be inclined to look with favor upon the stocking of crushed stone—not only because of the expense of rehandling, but because stone in the stock pile represents dead capital.

It is not possible in the light of our present knowledge to put up a crushing plant that will entirely eliminate stocking, but it is practicable to so equip the plant that stocking of the larger sizes will be unnecessary when there is a heavy demand for the smaller grades.

Advantages of Electric Power

The introduction of the electric motor into the crushing plant has been a great boon to plant flexibility; in fact, I do not believe I am going too far when I say that no other one factor approaches it in importance.

The freedom which it allows in the disposition of the various plant units was impossible under the older system of centralized drive. Nowadays the designer can arrange his machinery with very little thought of complications in power transmission by adopting the group or individual drive—thus sidestepping one of the greatest checkreins upon flexibility.

Broadly speaking, simplicity in plant design is attained in two ways: First, by reducing the number of units to a minimum, and, second, by simplifying the arrangement of these units and their auxiliary equipment.

A crushing plant is not merely an aggregation of machines—it is in itself a machine—dependent upon the efficient operation of its parts for its success as a whole.

Every part added to a machine—and, likewise, every machine added to a plant entails additional power and upkeep expense, and other things being equal, the plant with a few large units can be operated more economically than the one which is made up of a large number of small units.

I would not advocate that this principle be carried out at the sacrifice of flexibility, nor would I wish to set it up in opposition to the independent two-unit plant, which in my opinion constitutes a great feature of modern high capacity plant design.

There is a happy medium which good judgment will point out to the designer for each particular proposition.

Compactness in Design

Compactness will go hand in hand with simple plant design; its greatest value to the quarry operator lies in the saving of labor required to run the plant—and in the first cost of the buildings that house it.

A plant that is scattered all over a 10-acre lot is naturally going to require a larger operating crew than one that is housed in one building or in two buildings closely adjoining each other.

Like all good things, though, compactness can be carried too far. Accessibility—which is an oft neglected but none the less valuable feature—should never be sacrificed for the sake of obtaining a compact layout or cutting down the size of the buildings.

It would be a very good thing if every man responsible for a "sardine can" plant design could be made to get out and make a few repairs in it on a dark night. There would certainly be some startling improvements along the lines of accessibility in their future work.

Accessibility of Machinery

The screen house should be large enough to provide plenty of room around the screens; where screens are arranged in battery, room should be allowed for getting at each unit from at least one side.

Elevator pits should be made large and be well lighted, and it is best where possible to arrange for access to the pit from the rear so that the men who have to enter it will not be in danger of being caught in the buckets or struck by falling stones.

Safe runways and stairs should be provided for getting at overhead shafting; only an exceptional man will pay the proper attention to inspection and lubrication when this work involves undue fatigue or personal danger.

Much can be done in the average crushing plant to promote this feature of accessibility—not only as regards repairs, but also with respect to operation.

I have in mind a small plant in the East that was originally designed with the incline directly over the top of the primary crusher and at such a height as to prevent free access for feeding. This plant was equipped with a No. 6 primary machine.

After operating under this handicap for several seasons the incline was shifted to one side and raised so that the feeders were unhampered in their work—and the average output of the plant was increased 50 tons per day.

Selecting Crusher Types

The question of selecting the right type of crusher is one of the most widely debated questions among quarrymen and engineers. It is not surprising that this should be so.

My own observations lead me to believe that there have been more costly mistakes made in choosing the type of crusher to be used than in any other branch of crushing-plant design.

I believe we all have a very human tendency to become unduly enthusiastic over the merits of that particular type whose performance has been most favorable in our own personal experience. Also, the introduction of a new type, or its development in large sizes invariably instigates what might be called a short period of "faddism."

I have been fortunate enough during my own erecting and operating experience to come in contact with all of the three general types of main breakers and I will have to confess that, at one time and another, each of the three was a heavy favorite with me.

The truth of the matter is this: Strictly

speaking, there is no such thing as a universal crusher. I believe you will all agree with me that the gyratory more nearly approaches this definition than any of the other types, but even the gyratory has its limitations.

The man who is going to put his money into a new crusher will do well to make a careful study of the characteristics of all of them—to check these characteristics against the material to be crushed, the product desired, and the capacity wanted.

Only after such a comparison will he be qualified to make an intelligent selection of the right type for his particular work.

Study the Flow Sheet

One phase of crushing plant design that deserves more attention than is generally given it is a study of the flow sheet.

We all know that no two classes of rock have the same fracture and that for this reason a flow sheet can only be an approximation of what will actually take place in the plant. But even this approximation is vastly better than a rough guess, and anything that will help to eliminate guesswork is most certainly a step in the right direction.

The industry in general is in need of more scientific plant design—of a discarding of many of the old rule-of-thumb methods in favor of more systematic methods.

The older and more experienced engineers carry in their memory certain more or less clearly formulated rules and data which they are able to apply offhand to crushing plant problems as they arise; but the coming engineer is going to need more than that; he is going to need these rules and data and the results of the older engineer's experience in printed form; in order that he may have a starting point from which to carry on.

Such rules as there are to guide the crushing engineer must necessarily be empirical in character, and to be safe they must be based upon data which for any particular formula may take years to compile.

Operators Must Contribute Experience

These data must come chiefly from one source—from the operator—and anything that can be done to promote closer cooperation between the quarryman, the machinery manufacturer, and the engineer, for the purpose of furthering our present-day knowledge of crushing stone cannot help but benefit the industry.

What I have designated as *scientific* design should not be confused with *conservative* design.

It is safe to say that 95 out of every 100 plants represent what might be called conservative design.

Conservatism consists largely in profiting by your own and the other fellow's mistakes, or in a repetition of your own and the other fellow's successes.

Scientific principles will be more in the nature of a guilding light for the progressive quarryman and engineer—the men who are on the alert to try something new.

And in conclusion I want to say that to those of you quarrymen who, like Steve Brodie, were "willing to take a chance"; to the engineer who worked and worried to make his dream come true; and to the machinery manufacturer who put his faith and his money into new and progressive ventures in the way of larger and improved equipment, the crushed-stone industry owes much of its truly remarkable growth.

The New President of the National Limestone Agricultural Association

WE are lifting our kelly to the Kelley Island man who was unanimously elected to the presidency of the National Agricultural Limestone Association at its Columbus meeting—Edgar M. Lamkin, gentlemen! But—get this! He's no kin to the well-known lowly lamb even if he did look kinder sheepish when the ROCK PRODUCTS man nailed him for such facts in his past life that would get over in print.

Peppy—say! Live-wire and eager—oh, boy! And to the few who don't know him, give heed!

Edgar M. came into the stone industry about 1½ years ago as agricultural manager of the Kelley Island Lime and Transportation Co. These Kelley folks, alert to Edgar's training and mental store, grabbed

President Edgar M. Lamkin

him off from a big Eastern organization, with whom for 12 years he had directed the sales for two nationally known concerns, the Vacuum Oil Co. and Pratt & Lambert, Inc. So you see our hero, smooth as oil and bright as paint, brings to his new office a fine equipment for the duties he assumes as president, where his training and all-round ability will undoubtedly redound to the exceeding credit of the association and reflect its sound judgment in selecting the youngest president the association has ever chosen to guide its destinies.

And the Kelley Island folks, too, are keenly sensible of the honor of having one of its business family occupy the office of president of this association.

Michigan Producers Protest Rates Before State Commission

THE case of the Michigan Sand and Gravel Producers' Association against the Michigan carriers for reduction in freight rates on sand and gravel was heard by the Michigan Public Utilities Commission at Lansing on January 12. This second meeting of its kind in the state aroused keen interest in the large audience present.

The producers were represented by Executive Secretary George J. Bolender and the railroads by several attorneys and traffic men. "Abe Lincoln" Bolender had his fighting clothes on and gave the traffic men a two-day fight in their efforts to have the case thrown out. The case was adjourned to allow Secretary Bolender and the railroad men to attend the I. C. C. hearing at Washington on January 16, where the secretary represented the Ohio and Michigan associations, when the National Association of Sand and Gravel Producers was heard.

Wasting By-Products

FOR every ton of lime "burned" almost a ton of carbon dioxide—CO^2—goes up in smoke. Except in a few instances where limestone or magnesite is burned especially for CO^2, no attempt is made to recover and market this material. It has a number of industrial applications, best known of which is for carbonated beverages or soda water. For such purposes it has to be purified, and its recovery and production is an industry itself.

However, should the use of CO^2 in agriculture develop, as German experimenters seem to have reason to believe, not only would the market for the material be greatly enlarged, but a much less pure form would be required—a form that very likely any lime plant could furnish in abundance.

The possibilities of development along these lines are really wonderful. The German experimenter sees the day when plants furnishing CO^2 gas will pipe the material to surrounding agricultural territory much as illuminating gas and electricity are furnished today. It is a subject worth a little study and some dreaming.

Ohio Macadam Association Holds Annual Convention

Best and Most Profitable Meeting in the History of Association—A New Feature Is School for Teaching Salesmanship to Salesmen and Producers

PROBABLY the best and most profitable meeting the Ohio Macadam Association ever held took place at its annual convention in Columbus, Ohio, January 25 and 26. This meeting was a radical departure from the association's usual custom of having its annual banquet to which are invited the leading men in the State of Ohio. In fact, the annual Ohio Macadam Association banquet had become somewhat of a state institution.

Get-Together Conference

This year, the program was so arranged that one day was devoted to a "get-together" conference between producers, salesmen, superintendents, and the other day for a business meeting.

The joint conference between salesmen and operating officials and others interested in macadam roads was an innovation, and at the close of the session it was unanimously agreed by everybody present that it was the most valuable session ever conducted by the association.

The object of the school was twofold: First, to bring operators, proprietors and salesmen of crushed stone together so that they could thoroughly convince themselves that a macadam road was the best kind of a road; in other words, to sell themselves and believe in their own proposition before they sell the idea to someone else; second, to have convincing argument in hand so as to be ready to sell the prospective customer intelligently.

Macadam Road Costs

The meeting was an open affair and it was the privilege of anybody present to give voice to his opinions. H. M. Sharp, of the France Stone Co., Toledo, Ohio, gave a very convincing chalk talk in which he explained the cost of macadam roads as compared to other types of road and quick and ready ways or formulas for arriving at the cost of a macadam road. In this Mr. Sharp was assisted by P. K. Scheidler, The Barrett Co., Cleveland, Ohio, and the demonstrations made will undoubtedly prove to be of considerable assistance to every man present.

Secretary A. P. Sandles made a splendid address to the convention on the benefits that could be derived from the "schools" the association was now conducting. It is blazing a new trail for macadam roads and the work done that day, the exchange of ideas, the open and frank discussion of all problems, will result in a new era of prosperity for the Ohio Macadam Association.

Considerable discussion was given over to the association magazine, *Macadam Service*, and the sentiment it has created for good roads in the State of Ohio. In fact, it has become a power in the state for spreading the gospel of macadam roads and agricultural limestone and it is hoped that its circulation will be increased in the very near future.

The Banquet

A banquet was held the night of January 25. The public was not invited to attend this affair. As usual, Secretary Sandles conducted his "academy of wits and wisdom" and the stories told were many and humorous. O. A. White, of the Fate-Root-Heath Co., Plymouth, Ohio, made a fine address to the association on its value to the state and the place of the crushed-stone industry in the world. He made an inspiring eulogy of John Louden Macadam, inventor of macadam roads, and if every man present carried Mr. White's message home with him he was more than repaid for his trouble and expense in coming to the meeting.

Business Meeting

The annual business meeting of the association was devoted largely to a discussion of ways and means. The financial report showed that the association was in a very healthy condition and that *Macadam Service* was able to sustain itself.

The work of the "school" was commended and it was decided to have another "school" or get-together session at the next regular meeting of the association (the third Tuesday in February). It was also decided to hold more of these meetings and at different places designated by the executive board. A. Acton Hall, Ohio Marble Co., Piqua, Ohio, extended an invitation to the association to hold its next meeting at Piqua. This invitation was accepted by the membership. The chairman appointed a committee of three to arrange the details of the next meeting so that a program could be had and a definite line of action followed. It was the membership comment that this work was an invaluable feature.

The prospects for road building in Ohio were never better than they are now, according to discussions at this meeting and there is every reason to believe the Ohio quarrymen face a very prosperous year.

Officers Elected

The officers elected for the year are as follows: President, E. E. Evans, Whitehouse Stone Co., Toledo; first vice-president, G. H. Faist, Woodville Lime Products Co., Toledo; second vice-president, B. T. Van Camp, Van Camp Stone Co., Cincinnati; treasurer, W. H. Hoagland, Marble Cliff Quarries Co., Columbus; secretary, A. P. Sandles, and assistant secretary, Claude L. Clark.

An amendment was made to the by-laws increasing the number of the executive board. Those elected for 1922 are as follows: Allen Patterson, Bluffton-Lewisburg Stone Co., Lima; L. H. Hawblitz, France Stone Co., Toledo; A. Acton Hall, Ohio Marble Co., Piqua; W. H. Hoagland and President Evans as ex-officio members.

The directors of the association are as follows: J. F. Pogue, Hancock Stone Co., Findlay; J. A. Moore, Higgins Stone Co., Bellevue; L. A. Beigley, Standard Slag Co., Youngstown; J. A. McCall, Tarbox & McCall, Findlay; Allen Patterson, L. H. Hawblitz, W. H. Hoagland, A. Acton Hall, E. E. Evans, B. T. Van Camp, G. H. Faist and Willard D. Robinson, of the Toledo Stone and Glass Sand Co., Toledo.

Beg Pardon!

IN THE REPORT of the hearing of the complaint against the carriers by the American Sand Association, on page 74, January 14 issue, we were mistaken in saying that the American Radiator Co. "instructed the sand producers to ship all sand as 'Lake sand.'" Mr. McLaughlin, of the traffic department of that company, writes us that he said: "Lake sand is lake sand, whether consigned as industrial sand or building or highway sand, and for this reason we interpreted tariff to provide for the lower rate on lake sand consigned to our manufacturing properties and we have instructed sand shippers to bill lake sand as lake sand."

Explosives and Blasting

Important Relation of Explosives to the Economical Operation of Stone Quarries—Description of High Explosives and Modern Methods of Firing

THE important relation of explosives to the economical operation of stone quarries, with a description of the class of explosives used and the necessity for proper drilling and blasting, were the subjects of papers read by S. R. Russell of the Du Pont Co. and N. S. Greensfelder of the Hercules Powder Co. at the annual convention of the National Crushed Stone Association in Chicago on January 16 to 18.

Probably the largest single item of cost in the production of stone, aside from labor, declared Mr. Russell, is the item of "blasting cost," which includes, of course, both the cost of preparing the holes and of the explosives used in charging them. No attempt will be made to cover blasting in quarries in all its phases—just a few thoughts as to the selection of explosives for quarrying and the important relation they bear to the successful and economical operation of a stone quarry.

It is estimated that more than 60,000,000 lb. of high explosives were used in quarry and open-pit operations in the United States during 1920. A conservative estimate of their value would be $10,000,000. If to this is added the cost of black blasting powder —of which a considerable quantity is used in the stone industry—and the cost of blasting accessories, probably the quarrymen paid more than $12,000,000 for explosives alone during that year.

Today, almost all the important and successful operators are giving the matter of explosives serious consideration and study, for the manner of blasting affects every subsequent quarry operation—loading, conveying and crushing. If the drilling and blasting are not properly done—and these two operations should be considered together—the result will be a low shovel or loading efficiency, high secondary blasting cost, reduced output through the crusher and a final high cost per ton of stone. The blasting, therefore, is the heart of the whole quarry system and the selection and method of using explosives are vital matters.

Important Qualities Considered

Some of the most important qualities in the selecting of an explosive for quarry use are—strength, sensitiveness, stability, velocity or rate of detonation, ability to resist water and density. Upon the proper combination of these characteristics depends the adaptability of an explosive to the work at hand.

Strength is of prime importance, but a low-strength explosive is often better adapted to and will give more satisfactory results in some classes of work than one of high strength. Almost any strength is obtainable. The straight and ammonia types of dynamites may be had in all strengths from 15 up to 60 per cent. When it is necessary to use a higher strength gelatin dynamite must be used; it is manufactured in all strengths from 25 to 100 per cent.

The degree of sensitiveness is also of great consequence, for it is essential that an explosive be so sensitive that full detonation and maximum efficiency can be got out of it by the standard detonator, yet not be so sensitive that it becomes dangerous in ordinary handling and in transportation. Safety is also a prime consideration, and the balance of sensitiveness between efficiency and safety is one of the features which makes necessary expert knowledge and skill in manufacturing explosives.

Again, stability is highly important. No one wants an explosive that is liable to go off spontaneously during storage; that becomes more or less sensitive with age; that is affected by ordinary temperature changes.

Velocity of detonation or speed with which an explosive develops maximum pressure must also be considered. This quality varies greatly with different explosives. Where great shattering is desired an explosive with a high rate of detonation should be used, but where a heaving or rending action is required, a slower one is better adapted.

Some explosives will not resist water for any length of time, while others are almost unaffected by water; some are light and bulky, while others are heavy and dense. All these factors must be considered when deciding the explosive best adapted for a piece of work.

The manufacture of explosives is a highly scientific business, involving the maintenance of many trained chemists and engineers to assure the purity of raw materials, balance of ingredients in the formula and exactness in plant processes to produce explosives meeting the widely different conditions found in actual work and be uniform, stable and safe. American explosives manufacturers are today turning out a wonderfully efficient product.

Determining the Proper Explosive

It is sometimes a problem for the quarryman to determine the most economical and efficient explosive. Conditions vary so much in actual practice and there are so many different explosives made that it often requires considerable experimenting to arrive at the one best suited for the work. Explosives men, with a wider experience than any one operator can easily have, are always willing to co-operate and to assist the consumer in selecting the most economical and efficient explosive.

Many things must be considered in determining the proper explosive to employ—kind of quarry, whether pit, side hill or cliff; nature of the material, hard or soft, tough or brittle, limestone or trap, direction of strata, thickness of ledges, height of face or benches, method of drilling and loading, size of crusher, purpose for which the stone is used and whether the work is wet or dry. The system of drilling, the method of handling the stone and the selection of the explosive are more or less interdependent and are in turn influenced to a great extent by the height of the face, hardness and stratification of the stone, size of the crusher and output desired. While no hard and fast rules can be laid down to cover all operations, in quarries of the same class similar methods and explosives can usually be recommended.

The explosives generally used in United States quarries are straight nitroglycerin dynamites, extra or ammonia dynamites, gelatin dynamites, nitrostarch powders and, to a lesser extent, the comparatively recent type of explosives—light and bulky and marketed under various trade names. Straight dynamite, the original high explosive, is the standard against which all other explosives are measured. Straight dynamites are still generally considered the quickest and most shattering, although gelatin dynamites, when confined, are just as quick as and sometimes quicker than the corresponding grades of straight nitroglycerin dynamite. Gelatin dynamites are also the densest and heaviest commercial explosives and will resist water indefinitely, standing first in this respect.

Gelatin dynamites, unless under confinement, are relatively slow in action and should not be used for such work as mudcapping. The extra or ammonia dynamites are made by combining nitroglycerin, nitrate of ammonia and other explosive ingredients. They are slower in action than the corresponding grades of straight dynamite and will not resist water so well, but they have many desirable characteristics which make them well suited for general use in quarry work. As a rule, they are cheaper and safer to handle than other kinds. More ammonia dynamite is used in all classes of work than all other kinds put

together. The notrostarch explosives consist of nitrated starch mixed with nitrate of soda and nitrate of ammonia; they contain no nitroglycerin, are slower, more hygroscopic and less sensitive than the nitroglycerin compounds. Judson, or R. R. P., powder is a crude black powder, the grains of which are coated with nitroglycerin. It is well suited in tunnel or gopher-hole blasting in quarries, in sprung holes for removing lighter materials or where something stronger and quicker than black powder is desired. It is not suited to wet work.

Blasting Cost

In figuring blasting cost too much stress is generally laid upon the cost per pound of explosive rather than upon the cost per ton or yard of rock. The only way of arriving at a true cost and a true measure of explosive efficiency is by calculating the number of tons produced per pound, and by considering the shape in which the stone is produced and the other significant factors in the operation. Almost anyone can go into a quarry and reduce the explosive cost per ton. Either by using a cheaper priced or a lower grade explosive, or by arbitrarily cutting down the loads per hole, one may *move* just as many tons of stone per pound. Successful and economical blasting does not mean merely moving or throwing down so many tons of stone; it means throwing down the material in proper condition, consistent with the equipment for handling and the purpose for which it is to be used and with due regard for the after costs, as secondary blasting, loading, track movements and crushing. A lowering in the shovel efficiency on account of difficult digging caused by poor blasting, with consequent increase in shovel repairs, will far outweigh in cost any slight decrease in explosives cost per ton of stone. Frequently the use of a higher strength or different kind or greater quantity of explosive in the primary blast has resulted in a lower ultimate cost per ton.

It is not the *price per pound* of the explosive that is so important, but the *cost per ton* or *yard* of stone produced; not even the explosive cost per yard of the material as blasted but the final cost on the cars, which includes drilling, blasting, loading, transportation, crushing, overhead, etc. Blasting affects every item in the cost analysis and if it is not properly done, the cost of each subsequent operation will be higher than it should be.

Here is an actual case typical of many. The company was called upon by a large concern to visit one of their quarries where for some years they had been getting rather poor results. The costs were high and the output not commensurate with the plant capacity and equipment. They were using well drills and drilling 40 to 45 ft. holes, 5⅝ in. in diameter. Many of the holes were very wet, a 40-ft. hole sometimes containing 20 ft. of water. They were using a dynamite unsuited to wet conditions and cartridges 4 in. in diameter. The blaster naturally was afraid to break the cartridges and expose the dynamite directly to the water; consequently, they were loaded intact one on the other. The result was that the explosive could not be concentrated in the bore hole. The three steam shovels were working on an average of between 40 and 50 per cent capacity. It was not uncommon for a shovel to be held up four or five hours on account of drilling and blasting bottom. The drilling was rather carelessly done and the spacing for 45-ft. holes was 6 ft. apart and 12 ft. back—very close spacing for limestone. We changed over to gelatin dynamite, said Mr. Russell, increased the size of the cartridges to 4½ in. in diameter, reduced the drill-bit gage to 5¼ in. and made certain that all holes were drilled 5 ft. below the grade. After two years' trial, there is rarely any trouble with bottom, the shovel efficiency has jumped to 70 per cent, and two shovels are handling what it formerly required three to do. The spacing of holes has been widened to 8 ft. apart and 15 ft. back. The quarry is in better shape, the output greater, and the cost per ton less, notwithstanding the explosive now in use costs more per pound than the one formerly employed.

The drilling also was at fault and the explosive used was too light and otherwise unsuitable. The density of an explosive is very important in some quarries. If the bottom is hard or irregular, and there is no distinct parting at the floor of the quarry, it is absolutely necessary to concentrate the explosive charge at that point. This can be accomplished by completely filling the bore hole, by using a high-density explosive, or by drilling a sufficient depth below the floor grade. If much water is present it is almost impossible to pack the granular type of dynamite, hence a gelatin dynamite in cartridges with a diameter nearly as large as the hole is required.

Proper Drilling Methods

Proper drilling depth is of the greatest importance. Holes are not generally drilled deep enough below grade. To be sure of the proper depths it is advisable to run a line of levels over the floor and on top of the quarry face, establishing permanent bench marks and setting reference stakes at various stations around the face for the drill man. These stakes should indicate the depth to which the holes should be drilled. This little item alone may be worth a great many dollars to the quarryman in a season.

The use of large diameter cartridges is advisable in loading deep-well holes and manufacturers can furnish dynamite in all sizes up to 5 in. in diameter. Large cartridges lighten the labor of loading and permit a greater bore-hole density of the explosive in the bore hole. When large cartridges are used, very little tamping, often none at all, is necessary. Tamping here does not mean stemming. If holes are dry, the cartridges should be slit lengthwise two or three times and dropped or lowered into the hole. The fall causes the powder to spill out, practically filling the hole. Slitting the cartridges is not advisable when water is present. Do not hurry the work in loading explosives in quarries, especially in large holes, but furnish enough help so that loading will go on with dispatch. Such dispatch often results in saving money, especially if the holes are wet, and it also means disposing of a rather unpleasant and anxious job quickly. From four to six tons of stone is generally considered good for primary shooting in well-drill work. If the bottom is heavy or if there is a hard toe, use a higher strength explosive at that point, loading the upper part of the hole with lower grade.

Do not load holes when too near a steam shovel or locomotive, unless a screen or awning is used to prevent sparks or hot cinders from falling into the hole. Some very disastrous accidents have resulted from this cause alone in the last year or two.

In well-drill work the holes are usually drilled and blasted in single rows. Some experienced men think that better results and greater fragmentation are obtained by blasting two rows at a time. Most quarries, however, use the single-row system. The single row is best when the face of the stone is 50 ft. high or over; below that height, it depends upon local conditions. The general practice with relatively shallow holes from 20 to 30 ft. deep is to blast from two to five rows at a time in order to break the stone up well and in greater volume so that the track and shovel movements are kept at a minimum. When more than one row is carried, the holes in the back row should be loaded at least 10 per cent heavier than those in the front for best results, and the spacing between rows less than the distance from the first row to the edge of the face.

Use of Buffer

In high faces, the double row is not advisable at all. Often, even in quarries where the face is 50 ft. or under, only one row is blasted at a time, but a buffer of stone is carried; that is, a whole or part of a shovel cut from the previous blast left against the face to be shot. The buffer offers greater resistance or confinement to the charge and better fragmentation is gained. It is used in many cases, especially in lower faces, to hold back the material so that the stone is piled up high enough for economically working a steam

shovel and avoiding irregular track and frequent moving. In higher faces, from 50 to 200 ft., no buffer is necessary as each blast is cleaned up before another is thrown down.

The tripod method of drilling is well suited to quarries where the stratification is irregular or pitching heavily, and where it is impossible to maintain regular benches.

The Snake-Hole Method

In many of the harder limestone, trap and granite quarries, very economical results are obtained by the snake-hole method. In many of the Eastern quarries a 50 to 60-ft. face of rock is brought down with a single row of bottom holes which are heavily sprung. The holes are drilled horizontally at the bottom of the face from 20 to 30 ft. in depth and sprung heavily. It is best to start the hole about 3 ft. above the floor, allowing it to dip so that at the point it is just above or at the level of the floor. A certain dip must be maintained to allow water flow to the drilling surface.

It requires considerable judgment to spring holes successfully. After some experience the blaster soon gets sufficiently familiar with the ground to tell quite accurately how often he must spring, and how heavily, in order to accommodate sufficient pocket charge to lift the burden. Some rocks respond to springing much better than others. Holes are usually spaced about 8 ft. apart. A strong, quick explosive is best suited for springing holes. The first charge should not exceed three 1¼x8-in. cartridges. If there is drill muck or water this charge will not do much more than clean out the hole and will have a slight heating effect on the hole walls. If the hole is dry, this charge will enlarge it somewhat at the back and heat the walls. In the first case it is unnecessary to wait longer than half an hour before loading the second charge; if the hole is dry, it is advisable to wait 1 hr. The second charge should consist of, say, six cartridges; after firing, 1½ hr. should elapse before loading the third springing charge. Each subsequent springing charge is increased so that the chamber or pocket made by the preceding one is filled, or perhaps it is best to let the explosive rise a few inches more each time until the necessary size of chamber is obtained. Compressed air may be blown into the hole after springing, which, besides blowing out a great deal of pulverized rock, hastens the cooling and makes the work safer and quicker.

Many accidents have been caused by loading the final charge of explosive in the bore holes too soon after springing, the charge taking fire from the heat of the hole. A rough idea of the temperature can be gained by allowing the tamping stick to stand in the hole about 5 min. and then feeling the end of the stick to find out whether it is warm. To be absolutely sure, the intervals between charges should be:

After the first spring wait 1 hr.; the second, 2; the third, 3; the fourth, 4; the fifth, 5. It is seldom necessary to spring more than five times. It is advisable to wait after the last springing is done until the following day before loading the holes. A strong, quick explosive like 50 or 60 per cent Straight N. G. is best for springing in hard rock. For loading the chamber an explosive of lower strength and slower action is best.

For a secondary drilling, rotating hammer drills are now generally used. It is good practice to drill the large stone rather than to resort to adobe blasting or mud capping. It requires about 20 per cent as much dynamite loaded in a block hole to break a stone as it would require to "doby" it. Moreover, an explosive of lower strength than is used for primary shooting can be used for block hole work. Whereas a strong, quick explosive is required for mud capping, a 20 or 30 per cent ammonia dynamite is advised for block holes in the dolomites or hard limestones, and nothing higher than 40 per cent for traps or granites.

Mud capping except in emergency is very wasteful. When it is practiced the cost of secondary blasting averages about four tons per pound of explosive, while in block-hole work the cost runs from 15 to 18 tons per pound of explosive.

Only the best blasting accessories should be used with explosives. Great care should be exercised in testing electric blasting caps and in making connections, the joints being made tight, clean and dry. Only series connections can be made when blasting machines are used as a source of current, because these machines are designed only for series firing, having only about 1½ amperage, and a voltage sufficient to fire their rated capacity.

It is best to fire big blasts with a power or lighting circuit, say, either direct or alternating current of 25 cycles or over. It requires 1½ amp. to fire any number of electric blasting caps in series, but this strength must be maintained all along the circuit. Therefore, the greater the number of caps in series, the higher the pressure necessary to hold the current up. There should be supplied 1½ amp. and a voltage equivalent to 1½ times the number of caps in the series. It is better, however, when power is used for firing, to connect electric detonators in parallel or parallel series. When straight parallel is used in well drill work with electric blasting caps, ½ amp. should be provided for each cap in the circuit, when a high amperage but a low voltage is required. In parallel series, at least 1½ and better 2, amp. should be provided for each series.

In priming deep well drill holes use sufficient detonators distributed along the charge both to assure thorough detonation and to afford a way out in case one should be broken during loading; at least two caps should be loaded in any bore hole. Missed holes are expensive and often fraught with danger and no effort should be spared to prevent their occurrence. If the proper rules and instructions are carried out, there should be much less trouble from this source than unfortunately exists now in many quarries.

Cordeau-Bickford, or detonating fuse, is coming into general use for firing large blasts, is especially adapted for well drill hole blasts, and very safe, sure, efficient, and easy to manipulate. Cordeau consists of a lead tube about .22 in. in diameter, filled with T.N.T. It has a rate of detonation of about 18,000 ft. per sec. and is therefore of great value as a detonator in quickening slow explosives and assuring complete detonation of explosives of low sensitiveness.

Storage of Explosives

The storage of explosives is often sorely neglected. They should be stored in dry, well-ventilated magazines, preferably of brick construction, the walls being thick enough to be bullet proof. Cases of high explosives should be stacked in proper position and the oldest dynamite should be used first. Blasting accessories, such as electric blasting caps and blasting caps, should be stored in a separate cool, dry building.

Quarry operators are giving more attention to the subject of explosives. Many of the larger companies employ a blasting superintendent who devotes all his time to studying blasting methods and keeps in touch with the various plants. Accurate cost data are kept and in many instances a great saving has been accomplished, proving that close attention to this important question is worth while.

Where it is not possible to employ a blasting superintendent, the operator sees that the blasting is under the supervision of an intelligent foreman. This man should render a daily report showing the quantity of explosives used, the purpose for which they were used and where, with remarks showing the results obtained. He should see that explosives are properly stored and used; keep a record of stock on hand, using the oldest stock first, anticipate his needs to avoid running out and report them to the superintendent. As the blaster may either save or waste a considerable amount of money, an incentive should be given good men to take that position by making the remuneration commensurate with the danger and responsibility involved.

Mr. Russell concluded by stating that while undoubtedly there has been an awakening of interest in explosives among quarrymen, there is still much to be done in the way of reducing waste and increas-

ing efficiency and economy in quarry blasting.

Mr. Greensfelder's paper contained an exceedingly interesting account of the early history of quarrying, tracing its development from the early days of the Egyptians and Greeks up to the present time.

The effectiveness of any explosive, stated Mr. Greensfelder, is largely dependent upon the proper placement of the bore holes, and drilling, therefore, is of great importance. Drilling and blasting are so interdependent that one cannot make a proper plan for placement of drill holes without first considering the grade and strength of explosive which the bore holes are to receive.

Where there are numerous open joints the problem of drilling becomes complicated. Fissures in the rock tend to slow down the speed of drilling as well as making it more difficult. Furthermore, an open seam provides an avenue of escape for the gases from the detonated explosive charge, thus reducing the effectiveness of the shot. It is usually advisable to abandon a hole cutting such seams or cavities, as the cost of drilling in unsound rock is thereby increased.

If these joints are irregular and change in direction abruptly, many useless holes may be drilled unless systematic measurements of the joints are made with compass and clinometer and then carefully plotted on paper. Undoubtedly a chart of all the joints containing all the information possible is of great assistance in locating drill holes and avoiding the drilling of useless holes.

Primary and Secondary Blasting

The success or failure of a quarry may be determined by the study and attention given to blasting. Blasting at quarries may be considered under two distinct heads—primary blasting and secondary blasting.

Primary blasting refers to all shots made in the quarry ledge in its original position for the purpose of breaking down portions of the ledge into different sizes. Secondary blasting is that which is necessary to break up the larger rocks obtained from the primary blast into sizes small enough for subsequent handling for loading or crushing.

No problem which the quarryman encounters requires a greater amount of careful study to obtain satisfactory results than does primary blasting. This is due to the many varying conditions encountered in different sections, in different formations at the same quarry and at times irregularities and sudden changes in an individual formation at different points in the same quarry.

The chief variable factors affecting primary blasting are listed by the U. S. Bureau of Mines (Bulletin 160) as follows: (1) Height of face; (2) hardness and uniformity of rock; (3) altitude of beds; (4) prevalence of open bedding seams and joints; (5) altitude of quarry floor; (6) size and depth of drill holes; (7) arrangement and spacing of drill holes; (8) number of holes shot at one time; (9) size of charge; (10) position of charges in drill holes; (11) type of explosive used; (12) method of firing shots; (13) method of loading rock; (14) size of crusher. Each of these factors are considered by the careful quarryman in his blasting operations.

Straight Nitroglycerin Dynamite

Nitroglycerin dynamite is the standard by which all high explosives are measured on a weight-for-weight basis, therefore it should contain the actual amount of liquid nitroglycerin designed by its percentage strength. Its high rate of detonation makes it a good explosive to use where a strong shattering effect is desired. It resists water well, a valuable asset where wet holes are encountered.

Extra or ammonia dynamite has the same strength grade-for-grade as straight nitroglycerin dynamite. While its rate of detonation is not quite so high, it is a quick explosive. Its explosive base consists of nitroglycerin and ammonium nitrate. The latter will not resist water very long, but the cartridges of extra dynamite are dipped a second time in paraffin after they have been filled and the ammonium nitrate itself is coated with water-resisting compounds, so they will withstand the action of water for a considerable time if they are not split in loading. Extra dynamite is not as sensitive to friction or sparks as is straight dynamite.

Gelatin

When a small amount of nitrocotton is dissolved in nitroglycerin it forms a jelly-like substance which is a stronger explosive than pure nitroglycerin. When various absorbent materials are added the result is a plastic explosive denser than ordinary dynamite. Because of this density a given weight of gelatin can be confined in a smaller space than would be required to contain an equal weight of straight nitroglycerin or extra dynamite. This quality makes gelatin a decidedly advantageous explosive to use in hard, tight formations where a concentrated charge at the bottom of the bore hole is desired. Gelatin has a lower rate of detonation and, hence, is less shattering in its effect than straight nitroglycerin dynamite. However, when fired with cordeau, its quickness is increased.

Gelatin, extremely water resisting, is the best explosive to use when the explosive remains under water for a considerable time during loading operations. It is also unexcelled for underground work, because of its plasticity, density, imperviousness to water and good fumes.

Modern Methods of Firing

The introduction of electric blasting caps and cordeau detonating fuse were important contributions to the advancement of quarry blasting, continued Mr. Greensfelder. A great increase in efficiency is obtained by firing a number of holes simultaneously over that of firing them individually.

Electric blasting caps furnished the first effective method of simultaneous firing. By placing one or more of these caps in each hole and connecting them all to a power circuit or blasting machine, large numbers of holes may be effectively fired. When this system is employed and there is a high column of explosive in the hole, as in well-drilled holes, it is advisable to place several electric blasting caps at intervals in the charge to prevent the wave of detonation in the explosive from decreasing in velocity as it travels along the charge.

The straight parallel connection is the best for electrical blasting if there is sufficient current and voltage to put the current through the circuit. The reason for this is that some caps are more sensitive than others and in anything but a parallel connection the more sensitive ones may fire first and break the circuit. In the straight parallel connection each cap is independent and should fire regardless of the other caps. The parallel connection can not be used with a blasting machine because of the high current required. When the firing is done from a power circuit with sufficient current the parallel connection is the best.

The next best connection, and one which is good when sufficient current and votage for the straight parallel connection is not available, is to have the caps connected in groups, and have the caps in each group in parallel and the groups themselves in series. The number of caps and groups is dependent on the available current and voltage. The greater the number of series and the fewer the caps per series, the closer it approaches the straight parallel connection.

However, when a blasting machine is used to fire the blast, the straight series connection should be used because there is not enough current developed to fire a large number of holes connected in any of the other methods described.

A more recently developed means of detonation is with cordeau. This consists of a carefully drawn lead tube filled with trinitrotoluene. The three principal advantages claimed for cordeau are safety, instantaneous detonation and increased efficiency from the explosive charge.

Cordeau is so insensitive that it cannot be set off by friction, fire or any ordinary shock, but requires for detona-

tion an extremely violent shock, such as that produced by a blasting cap. The average rate of detonation is about 17,500 ft. per sec. Therefore, when it is placed along an explosive charge, the entire column is detonated at a rate equal to that of the cordeau. The increase of the rate of detonation thus obtained, particularly with the slower dynamites, increases their shattering effect and consequently decreases the cost of secondary blasting.

Where the explosive charge is placed at different points along the hole, cordeau furnishes a particularly convenient and efficient means of detonation. When loading a deep hole with cordeau, run an iron bar through the hole in the center of the spool on which it is wound. Lace the end of the cordeau through a dynamite cartridge, which acts as a weight in lowering the cordeau down to the bottom of the hole. When the dynamite cartridge reaches the bottom, draw the cordeau taut, so that it will lie along the side of the hole and not interfere with further loading. The explosive charge can be broken as many times as desired because the cordeau will detonate throughout the entire length of the hole. The cordeau is then cut off a short distance above the top of the hole, and the end weighted down by a loose stone to hold it taut during the loading.

When all the holes are loaded and the surface cleared for the shot, the main line of cordeau is unreeled across the tops of the holes and the cordeau in each hole is connected to the main line. This is done by slitting the piece of cordeau which extends from the hole and twisting the ends tightly around the main line. When all the holes are connected to the main line a blasting cap or electric blasting cap is connected to the end of the main line. The firing of this cap detonates the entire blast.

Always arrange the main line of the cordeau so that the detonating wave reaches the row of holes next to the face of the quarry first and then the other rows in the order they recede from the face.

It is well, whenever possible, to make a complete circuit of the main line so that every row of holes will have two ways by which the detonating wave can reach it.

Sand Association Elects Officers

Retiring President Thrall and Secretary Fuller Report on the Hearing Before the Central Freight Association at Chicago

THE principal features of the annual meeting of the American Sand Association at Cleveland on January 11 were the election of officers and the report of the retiring president, F. R. Thrall, and the Association's general counsel, Hubert B. Fuller, of the hearing before the general committee of the Central Freight Association at Chicago on January 10.

This hearing was a protest against the classification of sands for rate-making purposes, according to the uses for which they might be intended, an innovation recently inaugurated in the tariffs recently published by the carriers in the Central Freight Association territory, inaugurating certain changes in rates on interstate shipments. The proceedings of this hearing were published in ROCK PRODUCTS for January 14.

Theodore B. Ely, president

Hubert B. Fuller, secretary and counsel

The new officers are: President, Theodore B. Ely, Venango Sand Co., Franklin, Pa.; first vice-president, W. H. Smith, Superior Sand Co., Cleveland; second vice-president, E. E. Klooz, Portage Silica Co., Youngstown, Ohio. Directors, E. M. Ayers, Ayers Mineral Co., Zanesville, Ohio; L. R. Farrell, Portage Silica Co., Youngstown, Ohio; F. L. Moore, Peerless Sand Co., Conneaut, Ohio; M. M. Everhard, the Everhard Co., Massillon, Ohio; R. F. Thrall, Geauga Silica Sand Co., Cleveland, Ohio, and N. M. Jones, Jones Sand Co., Columbus, Ohio; Hubert B. Fuller, Cleveland, Ohio, secretary and general counsel.

E. E. Klooz, vice-president

Sand and Gravel Producers Heard by the I. C. C.

Irrefutable Evidence Given of Unjustifiable Rates—Brooker Gets Six-Hour Grilling But Delivers Many Telling Blows

THE case of the National Association of Sand and Gravel Producers against the Pennsylvania Railroad and other carriers for a general reduction in freight rates on sand, gravel and crushed stone between the states in the Central Freight Association territory was presented in complete and impressive fashion before Examiner Hosmer of the Interstate Commerce Commission at Washington on January 16, 17 and 18. The hearing was then adjourned to Wednesday, January 25, when, after cross-examination of witnesses for the producers, the defendant carriers will have their innings.

Examiner Hosmer denied an eleventh-hour effort of counsel for the railroads to file a petition that the commission raise intrastate rates in Ohio and in other states where intrastate rates are lower than interstate rates, to the level of the interstate rates. The examiner took under consideration a formal motion of counsel for the carriers to strike out from the complaint of the producers sections constituting its heart.

Witnesses for the producers, whose case was in charge of John S. Burchmore and Luther M. Walter of the Chicago law firm of Borders, Walter, Burchmore and Collin, declared that the existing rates are curtailing production and restricting movement of traffic by the railroads. The most important witness for the producers was Edwin Brooker of Washington, traffic representative for the National Association. He was on the stand for six hours and received many congratulations for the telling blows he delivered on behalf of the producers, who furnish the railroads more tonnage than any other industry except that of coal.

A. W. Dann, Pittsburgh, of the Keystone Sand and Supply Co., and chairman of the transportation committee of the National Association, was the first witness and presented the situation in a general way. He gave testimony showing how high freight rates have diverted business to truck and water lines. He dealt with the competition between slag and gravel and showed that the sand and gravel producers in the territory affected are greatly handicapped because of the lower rates on slag. Mr. Dann related in full the story of the long fight by the sand and gravel producers to be relieved of excessive freight rates.

Mr. Dann placed in evidence an exhibit showing how high freight rates have forced business to truck and water lines. This was a comparison of shipments by way of railroad, truck and water for 1919, 1920 and 1921 from plants of the Keystone Sand and Supply Co. at Groveton, Neville Island and McKeesport, Pa. In 1919 the railroads carried 90.4 per cent of the shipments; in 1920, 77.4 per cent; in 1921, 56.7. In 1921, more than 40 per cent was carried by water.

A. H. McComb of the Universal Sand Co., Newcastle, Pa., supplemented Mr. Dann's testimony by giving specific illustrations of the effect of high rates upon his business and pointed out his inability to meet slag competition because of the lower rates allowed the latter.

G. C. Ross, representing the Ohio Valley sand and gravel producers, told of conditions in Southeastern Ohio. J. P. Johnson, surveyor of Hendricks City, Ind., and president of the Indiana Association of City Surveyors and Engineers, showed the effect of the high freight rates on road building, making necessary the use of unwashed pit-run gravel in 1921 in place of material formerly obtained from established plants by railroads when rates were lower. He gave results of a questionnaire sent out to all city surveyors in his state, indicating that in Indiana alone more than 3,000,000 tons of local material was used during 1921 in lieu of shipped material. A copy of this questionnaire, together with a summary of the answers received to each question, was placed in evidence. A summary of this questionnaire showed, among other things, that 33 out of the 44 surveyors estimated that high rates had affected the movement of road materials; 17 estimated that 373,600 tons of local material had been substituted; 21 that 781,200 tons of business was lost because of high transportation cost; 39 that the principal objections to building this spring included high freight rates; that nearly 50 per cent of the surveyors had changed the specifications to permit the use of local materials.

C. M. Ault of the Barnes Sand and Gravel Co., Piketon, Ohio, showed in conclusive manner how high rates have decreased shipments from his company, with the result that he is unable to reach various markets in which he formerly sold. H. E. Neal of the Neal Gravel Co., Mattoon, Ill., and General Manager Witty of the Wabash Sand and Gravel Co. gave information as to plant operations and loss of business from the plants due to existing rates.

R. C. Yeoman, extension engineer for the Indiana Sand and Gravel Producers' Association, filed exhibits showing the loss of sand and gravel shipments to railroads on account of high rates. Here it was shown that more than 636,000 tons of material were lost to the railroads.

Guy C. Baker, vice-president of the Greenville Gravel Co., Greenville, Ohio, a company which also has plants in Indiana and Michigan, told of the reduction which the Ohio producers' association, of which he is secretary, recently obtained in that state. A 40 per cent increase was eliminated, the result being some benefit to the producers and an increase in tonnage carried by the railroads. The reduction, however, Mr. Baker declared, was not sufficient to permit free movement of traffic by the railroads and the witness was very positive in his assertion that nothing but restoration of pre-war conditions as to freight rates would place the sand and gravel industry on a sound basis. Mr. Baker declared it obviously in the interest of the carriers to co-operate in restoring these conditions.

Twenty-four exhibits were filed with the examiner by Edwin Brooker, traffic representative of the National Association. Mr. Brooker's testimony can be summarized as follows:

1. A history and comparison of the rates from representative plants in Illinois, Indiana, Ohio and Western Pennsylvania, from 1917 to date. The increases have been from 111 to 300 per cent in that period. One striking illustration was the case of a producer once able to ship 159 miles for 56 cents a ton. Today it costs this producer 58 cents a ton to ship four miles. This was only one example of how the market radii of the sand and gravel producers have been materially reduced by high rates.

2. Exhibits indicating excessive per car and per car mile earnings by carriers un-

der existing rates. These exhibits showed that the average earnings of the carriers from sand and gravel shipments today are considerably in excess of the average earnings on all freight.

3. Further illustrations of statements of shipments of sand and gravel from numerous plants, as of July, 1921, to show decreased shipments.

4. Exhibits showing preponderance of movement was during months when operating conditions were more favorable and when open-top cars were not in great demand for movement of coal. Shipments of representative companies in Michigan, Pennsylvania, Indiana and Ohio for 1921 were filed to bring out the indication that more than 90 per cent of the traffic movement from April to November, inclusive, showed an average loading for 1921, as follows:

Michigan, seven plants; total of 17,087 cars; average of 52.5 tons to a car. Pennsylvania, 10 plants; total of 16,840 cars; average of 56.4 tons to a car. Indiana, 18 plants; total of 19,370 cars; average of 50.8 tons to a car. Ohio, four plants; total of 5438 cars; average of 54.1 tons to a car.

5. Relation of terminal service based on difference in loading. This was illustrated by a chart showing that the service performed on a ton of sand and gravel, loading 50 tons to a car, was only 20 per cent of the service necessary on a commodity loading 10 tons to a car. As compared with a commodity loading 20 tons to a car, the service on sand and gravel was only 40 per cent by comparison. As compared to a commodity loading 30 tons to a car, the service on sand and gravel was only 60 per cent in comparison.

6. The lower cost of service on sand and gravel was further illustrated by another chart, showing the relation of revenue freight hauled by engine as compared to dead weight of an empty car, indicating that it requires less cars to move a greater amount of tonnage on a commodity loading 50 tons to a car. It also was indicated that the consequent items of investment taxes, depreciation, maintenance and repairs, per diem, terminal service, billing and auditing, were considerably less on a commodity like sand and gravel, loading 50 tons to a car, than on lighter loading commodities.

7. Freight and operating statistics of various railroads were cited to show that in the period from January to October, 1921, the freight and total operating revenues revealed a decided improvement during the latter part of 1921. Mr. Brooker declared there had been material reductions in the operating expenses of the carriers.

8. An elaborate presentation of differences in freight rates on sand and gravel and slag, showing in some cases that slag was being transported at one-half the rate charged for sand and gravel.

Mr. Brooker argued that the exhibits "demonstrated beyond argument that existing rates are excessive and unreasonable and that the railroads clearly can afford to transport sand and gravel at lower rates."

G. J. Bolender, traffic manager for the Kalamazoo, Mich., Chamber of Commerce and secretary of the Michigan Producers' Association, presented exhibits concerning conditions in Michigan and Ohio confirming the testimony of Mr. Brooker.

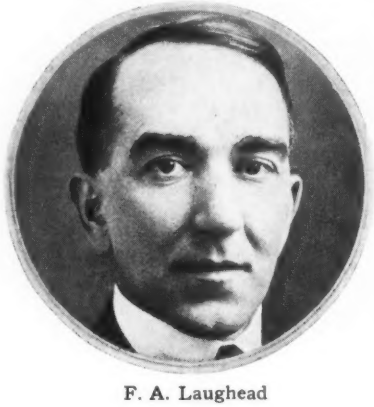
V. O. Johnston, of the Lincoln Sand and Gravel Co., Lincoln, Ill., and president of the National Association, gave testimony covering the present plight of the industry in general and contending that the necessity of prompt relief had been demonstrated beyond cavil. One of Mr. Johnston's exhibits shows that 104,818 tons were directed to trucks in 1921 and 47,034 tons in 1920.

Charles Donley, Pittsburgh, appeared as a traffic representative for the Ohio Valley Producers' Association and gave valuable assistance in support of the arguments that present rates are injurious both to producers and carriers.

By agreement with the railroads concerned, the state of Wisconsin and that part of northern Illinois located on western roads was eliminated from the pending case and the latter confined strictly to the Central Freight Association territory, which covers territory in southern Illinois and east thereof to Buffalo and Pittsburgh.

National Sand and Gravel Producers Get Field Secretary

F. A. LAUGHEAD, former executive for the Missouri Valley Association of Sand and Gravel Producers, has been appointed field secretary for the National



F. A. Laughead

Association of Sand and Gravel Producers. Mr. Laughead's work will be entirely in the field, developing weak organizations to get on a firm basis, promoting new memberships, etc. This addition is a valuable asset to the 1922 activities of the National Association's work.

U. S. Government Begins Suit Against Cement Securities Co.

IT WAS announced at Washington on January 10 that Attorney - General Daugherty had instructed the United States attorney at Denver, Colo., to institute a suit under the Sherman anti-trust act against the Cement Securities Co., its six subsidiary cement manufacturing companies—the Colorado Portland Cement Co., Union Portland Cement Co., Three Forks Portland Cement Co., the United States Portland Cement Co., Oklahoma Portland Cement Co., and Nebraska Cement Co.—have mills in Colorado, Utah, Montana, Oklahoma and Nebraska.

Among other things, the Government charges that the real purpose for which the Cement Securities Co. was organized was to eliminate competition between manufacturing companies in which certain of its promoters were interested; to acquire and absorb or dismantle independent mills; to attain a monopoly of the portland cement industry in the Rocky Mountain states; and to insure its territory against invasion by potential competitors. The Government asks that the Cement Securities Co. be dissolved into separate units so as to restore competitive conditions.

In commenting upon this suit, Attorney-General Daugherty pointed out that it is one of a series of proceedings to restore competitive conditions in the cement industry. The Cement Securities Co. is strictly a holding company. In the cases heretofore instituted the defendants are charged with accomplishing their alleged unlawful objects through so-called "open price associations."

Missouri Highway Engineers Will Fight High Rates

HIGH freight rates on road material are retarding the construction program in Missouri to such an extent that the state highway engineers' association will fight until "the freight rates are at least in proportion with the existing freight rates on other commodities."

This action was taken at the recent Kansas City meeting of the association when the rates were declared "the enemy of the good roads movement." The following resolution was adopted:

"In the cost of building roads the freight rates are entirely out of proportion to the items of raw material and labor that go to make up the cost of road construction. Notwithstanding a reduction within the past two years in the cost of raw material varies from 25 to 75 per cent, and in the cost of labor from 25 to 50 per cent, with an abundant supply, the freight rates on raw material not only have not been reduced, but in many cases have been increased."

Grading of Sand for Sand-Lime Brick*

The Effect of Grading of Sand Upon Absorption and Transverse Strength of Sand-Lime Brick

By W. E. Emley and H. V. Johnson

By Permission of the Director of the U. S. Bureau of Standards

IN the Sand-Lime Brick Association proceedings for 1917, 1918 and 1919 are reports of investigations carried on by Warren E. Emley and Samuel Freed, F. A. Kirkpatrick and F. W. Lapham under the general heading, "Effect of Various Factors Upon the Properties of Sand-Lime Brick." The report here given is based upon a continuation of the same research at the Bureau of Standards during the past six months, but its scope is limited to the effect of grading of sand upon transverse strength and absorption of sand-lime brick.

For this particular work Potomac river sand was divided into different grades by the use of standard testing sieves. The grades are designated as follows: 8-16, 16-30, 30-50, 50-70, 70-100, 100, 200, through 200. The meaning of 8-16 is that this particular grade of sand passed a No. 8 sieve and was retained by a No. 16 sieve, and so on for the other grades. The following is a description of the sieves:

No. of Meshes Per Inch	Size of Opening Inches	Millimeters
8	0.0937	2.38
16	0.0469	1.19
30	0.0232	0.59
50	0.0117	0.297
70	0.0083	0.21
100	0.0059	0.149
200	0.0029	0.074

In the first 17 combinations of grades of sand that were made, the fine material passing a No. 200 sieve was not used; also the sand passing a No. 48 sieve and retained on a No. 100 sieve was not separated into two grades by the use of a No. 70. It was found later that 64 per cent of this 50-100 sand was retained on a No. 70 sieve, and 36 per cent passed this sieve.

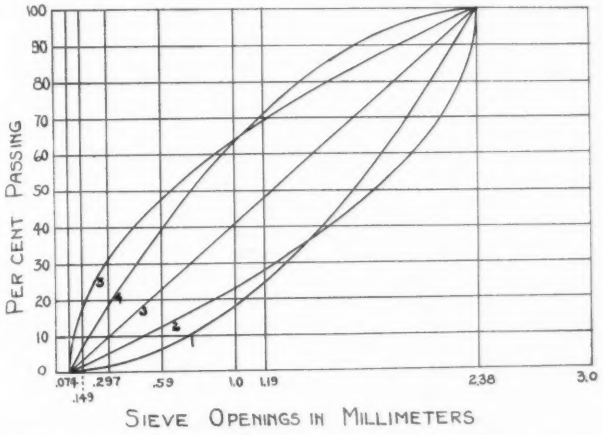


Fig. 1. Curves showing grading of sand portions, Nos. 1 to 5

In reviewing the subject of grading of sand for concrete mixtures, it was found that the strongest concrete is obtained if the different grades of sand are combined in such proportions that when the percentages of sand passing each particular sieve are plotted against the sizes of sieve openings, and these points connected, the line thus formed is a parabola. It therefore seemed advisable to try out such a scheme of grading for sand-lime brick. Following this suggestion, the sands were re-combined into gradings represented by the curves in Fig. 1, one of which is a straight line and the other four are parabolas. During all of this research (except that given in Table 6), 90 per cent of sand was mixed dry with 10 per cent of Berkeley hydrate. The mixtures were brought to the proper consistency by adding water. The proper consistency is such that, when the bricks are being pressed, a drop or two of water makes its appearance to indicate that there is neither a shortage nor an excess of water in the mixture.

The dampened mixtures were tamped into a mold which was 4 in. long and 1 in. wide, and of sufficient depth so that the pressed blocks could be about 4x1x1 in. in size. There were two plungers, one below and one above, fitting into this mold. A pressure of 50,000 lb. was applied, making 12,500 lb. per sq. in. After the first pressure, the mold was turned upside down and subjected to the same pressure again. The mold was then turned

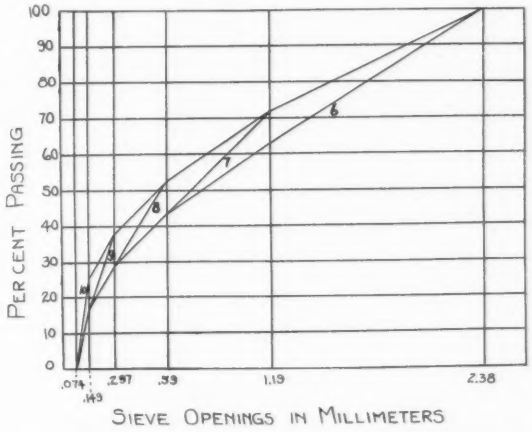


Fig. 2. Curves showing grading of sand portions, Nos. 6 to 10

*Paper read at annual convention of the Sand-Lime Brick Association, Dayton, Ohio, April 25, 1921.

right side up and pressure applied for the third time. Then the brick was pushed out of the mold by pressure on the upper plunger, this pressure sometimes registering as much as 7,000 lb.

The bricks were hardened in an autoclave 12 in. in height and 6 in. in diameter, capable of holding as many as 28 of these bricks. The steam pressure was 120 lb. per sq. in. (gage reading), which was maintained for four hours. The bricks were then removed from the hardening cylinder and left at room temperature over night. They were dried the next day in an oven at a temperature of 120 deg. C. for about seven hours. After cooling over night, they were tested for transverse strength by supporting them on knife edges 3.5 in. apart, while the load was applied to a third knife edge resting on the middle of the brick.

Transverse strength is designated as "Modulus of Rupture," and is computed in pounds per square inch by means of the following formula:

$R = 3Wl \div 2bd^2$ where:

W=weight applied in pounds.
l=distance between supports in inches.
b=breadth in inches.
d=depth in inches.

To determine the percentage of absorption, one piece from each broken brick, which was still dry, was weighed, then immersed in water and boiled for 5 hr., and weighed again. The increase in weight shows the amount of water absorbed, and it was computed as percentage of the weight of the dry brick.

The figures obtained during the first series of tests, where five different gradings of sand were used, are given in Table No. 1. Grading No. 5 gave a brick of greatest transverse strength. An inspection of the curves in Fig. 1 suggests as a possible reason for this the greater percentage of fine sand in this mixture.

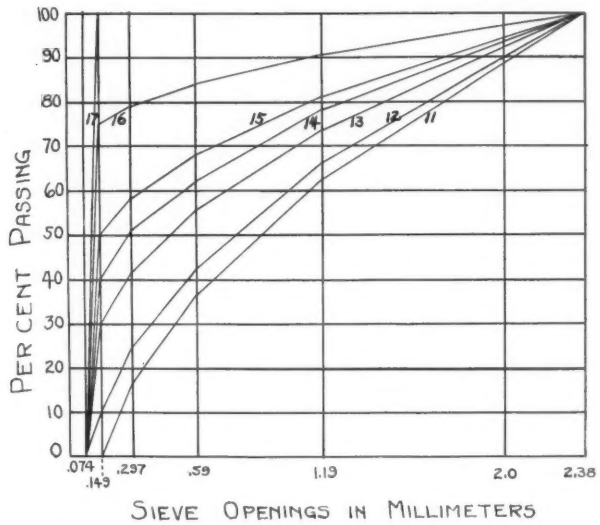


Fig. 3. Curves showing grading of sand portions, Nos. 11 to 17

At this point a chemical analysis was made on a half-brick from each of the five gradings, for the purpose of determining whether or not the difference in transverse strength could be accounted for by any difference in cementing material that might have been formed. The percentages of calcium found, as free lime, carbonate and silicate are given in Table No. 2. However, these results do not furnish any decisive information as to why mixture No. 5 produced the strongest brick in this first series.

In the second series of gradings, each individual mixture was made similar to No. 5, except that each one of the five grades of sand was increased in turn while the other four were proportionately decreased. For example: In grading No. 6, the coarsest grade of sand, 8-16, was increased, while the other four were decreased so as to keep the percentage 100, and so as to keep the relative amounts of these four grades the same as they were in grading No. 5. The strongest bricks in this series came from grading No. 10, Table 1, where the finest grade of sand was increased, while the other grades were proportionately decreased.

A third series of gradings was made in which the finest grade of sand was increased in varying percentages, the other grades being proportionately decreased. The percentage composition is shown by the curves in Fig. 3, and the results are given in Table No. 1, gradings 11 to 17. It was found that 100 per cent of the finest grade gave a stronger brick than any of the other mixtures, but the absorption was higher.

The fourth series of tests was conducted on bricks made from the seven different grades of sand given in Table No. 3, Nos. 18 to 23, each grade constituting 100 per cent of sand portion. Again the finest material is found to give a brick of the greatest transverse strength, but apparently there is an increase in absorption as the degree of fineness increases. This is also shown by the absorption figures for individual grades of Ottawa sand, given in Table No. 5. In the fifth series of tests, experiments were conducted on mixtures consisting of 50 per cent of sand of 100-200 combined with 50 per cent of each of the other grades in turn. But none of these mixtures gave so strong a brick as 100 per cent of the 100-200 material (See Table No. 3, Nos. 24 to 29). The material passing No. 200 sieve gave a stronger brick, but this material contains some clay, so that it would not be entirely safe to attribute all of the noted increase in strength to the greater degree of fineness of the sand.

Another series of tests was conducted on bricks made from sands from various localities, and on bricks made from Potomac river sand of the same gradings. The locality from which these sands were obtained, their sieving analyses, and the absorption and the transverse strength of the bricks are given in Table No. 4. Sands from New York, Wilmington, Del., and Filer, Idaho, gave stronger bricks than Potomac river sands of the same gradings. Some others are equal to Potomac river sand, while others are inferior. Potomac river sand ranks among the best sands. A round-grained quartz sand, like Ottawa sand, was found to produce a poor brick in regard to transverse strength. This was shown by the yellow quartz sand from West Palm Beach, Florida, by Mississippi river sand from St. Louis, Mo., and by Ottawa sand. (See Tables 4 and 5.)

An investigation was made of the effect of the amount of lime upon a coarse grade and upon a fine grade of Potomac river sand. The composition of the bricks by weight varied from 10 to 90 per cent of lime, the remainder of the 100 per cent in each case being sand. (See Table No. 6.) When 20 per cent lime and 80 per cent sand of 16-30 were used, there was a decided drop in transverse strength below that given by bricks made from 10 per cent lime and 90 per cent of the same grade of sand. But with increase in lime above 20 per cent, there is an increase in transverse strength in each case. Bricks made from 80 per cent of this grade of sand and 20 per cent of lime were weaker than bricks made from 90 per cent of the same grade of sand and 10 per cent of lime, because 20 per cent is more lime than can react with the given surface exposed to its action by these sand grains, and this extra lime is prevented from reaching its maximum degree of packing due to the interfering skeleton or framework of coarse sand grains. But when the excess of lime has sufficiently increased, we have a mass of lime with scattered sand grains not materially interfering with its packing. Three bricks made of 100 per cent lime (no sand) gave an average modulus of rupture of

1,459 lb. per sq. in., which is greater than that given by 30 per cent of this sand mixed with 70 per cent of lime. This figure was not inserted in Table No. 6 on account of the thinness of the bricks made from 100 per cent of lime. It was impossible to tamp enough lime into the mold to make a brick 1 in. thick. If a second lot of lime were added it was found impossible to make it adhere to the first lot. A deeper mold would be necessary to make a lime brick 1 in. thick.

In the case of sand of grade 100-200, 50 per cent of this sand and 50 per cent of lime gave the maximum strength. An explanation of the difference in the lime requirements of these two grades of sand for maximum strength of each, will throw some light on why the addition of fine sand gave greater transverse strength than the addition of coarse sand, in the experiments mentioned. If a sphere is cut into two parts, the original surface is still exposed, and in addition twice the area of the cut surface. The additional exposed surface increases just as long as the process of dividing the sphere increases. This applies equally well to sand grains. Therefore, at least one reason for the value of fine sand over coarse sand must be its greater surface which is exposed to the action of the lime.

TABLE NO. 1
Composition of Sand Portions of Specimens by Weight

No.	8-16	16-30	30-50	50-100	100-200	Absorption	Modulus of Rupture. Lb. per sq. in.
1	76.	18.	5.	1.	0.3	8.5%	252
2	72.	16.	7.	3.	2.	8.7	379
3	52.	25.	13.	7.	3.	8.5	331
4	29.	23.	17.	13.	18.	8.0	574
5	31.	21.	16.	14.	18.	8.1	678
6	37.	20.	14.	13.	16.	7.7	603
7	28.	29.	14.	13.	16.	8.1	669
8	28.	20.	23.	13.	16.	8.4	713
9	28.	20.	14.	22.	16.	8.0	836
10	28.	20.	14.	13.	25.	8.1	842
11	38.	26.	20.	16.	0.	8.0	606
12	33.	24.	18.	15.	10.	7.6	634
13	26.	19.	13.	12.	30.	7.5	1000
14	22.	16.	12.	10.	40.	7.9	1061
15	19.	13.	10.	8.	50.	8.0	1069
16	9.	7.	5.	4.	75.	8.8	1159
17	0.	0.	0.	0.	100.	12.2	1291

TABLE NO. 2
Chemical Analysis of Bricks

No.	Absorption	Modulus of Rupture. Lb. per sq. in.	As Free lime	Percentages of Calcium: As Carbonate	Total Calcium	As Silicate
1	8.5%	252	0.08%	2.19%	4.62% 8.55% $Ca(OH)_2$	2.35%
2	8.7%	379	0.032%	2.28%	5.00% 9.25% $Ca(OH)_2$	2.69%
3	8.5%	331	0.024%	2.72%	4.90% 9.06% $Ca(OH)_2$	2.16%
4	8.0%	574	0.072%	2.35%	4.67% 8.64% $Ca(OH)_2$	2.25%
5	8.1%	678	0.012%	2.54%	5.01% 9.27% $Ca(OH)_2$	2.46%

TABLE NO. 3
Composition of Sand Portions of Specimens by Weight

No.	8-16	16-30	30 50	50-70	70-100	100-200	Thru 200	Absorption Pct.	Modulus of Rupture Lb./Sq. In.
18	100	.....	.....	.....	.....	.....	.....	8.4	305
19	.....	100	.....	.....	.....	.....	.....	9.2	504
20	.....	.....	100	.....	.....	.....	.....	9.4	762
21	.....	.....	.....	100	.....	.....	.....	10.9	1080
22	.....	.....	.....	.....	100	.....	.....	10.4	1302
17	.....	.....	.....	.....	.....	100	.....	12.2	1291
23	.....	.....	.....	.....	.....	.....	100	10.4	1817
24	50	.....	.....	.....	.....	50	.....	10.3	556
25	.....	50	.....	.....	.....	50	.....	10.3	869
26	.....	.....	50	.....	.....	50	.....	11.7	986
27	.....	.....	.....	50	.....	50	.....	12.5	1077
28	.....	.....	.....	.....	50	50	.....	12.1	1159
17	.....	.....	.....	.....	.....	100	.....	12.2	1291
29	.....	.....	.....	.....	.....	50	50	10.8	1751
23	.....	.....	.....	.....	.....	.....	100	10.4	1817

TABLE NO. 4
Comparison of Bricks Made from Various Sands with Bricks Made from Potomac River Sand of the Same Gradings
Composition of Sand Portions of Specimens by Weight

Locality	8-16	16-30	30-50	50-70	70-100	100-200	Absorption Pct.	Modulus of Rupture lb./sq. in.
West Palm Beach, Fla. (white)	0.3	3.	28.	33.	27.	9.	0.05	1151
Potomac River	.....	.....	.....	.....	.....	.....	9.9	1189
West Palm Beach, Fla. (yellow)	0.01	2.	36.	40.	19.	3.	0.02	760
Potomac River	.....	.....	.....	.....	.....	.....	10.0	1187
San Francisco (bank sand)	0.01	0.2	25.	40.	29.	5.	0.45	964
Potomac River	.....	.....	.....	.....	.....	.....	11.4	1172
West Rutland, Vt.	5.	27.	26.	12.	11.	12.	7.	1074
Potomac River	.....	.....	.....	.....	.....	.....	8.6	1090
Baltimore, Md.	1.	10.	63.	19.	5.	1.	1.	898
Potomac River	.....	.....	.....	.....	.....	.....	9.8	987
Los Angeles	10.	20.	33.	17.	12.	6.	2.	719
Potomac River	.....	.....	.....	.....	.....	.....	9.4	981
Smithwick, S. D.	15.	27.	33.	10.	10.	5.	0.3	741
Potomac River	.....	.....	.....	.....	.....	.....	9.0	815
St. Louis, Mo., Mississippi River	12.	31.	41.	9.	5.	2.	0.3	322
Potomac River	.....	.....	.....	.....	.....	.....	11.3	728
New York	10.	16.	41.	17.	9.	5.	2.	747
Potomac River	.....	.....	.....	.....	.....	.....	10.0	643
Filer, Idaho	9.	17.	37.	19.	9.	6.	3.	734
Potomac River	.....	.....	.....	.....	.....	.....	10.8	624
Louisville, Ky.	2.	12.	72.	6.	8.	0.1	0.06	591
Potomac River	.....	.....	.....	.....	.....	.....	10.8	612
Wilmington, Del.	0.6	4.	60.	27.	6.	2.	0.4	969
Potomac River	.....	.....	.....	.....	.....	.....	9.6	489
Laramie, Wyo.	60.	35.	3.7	0.5	0.4	0.3	0.1	299
Potomac River	.....	.....	.....	.....	.....	.....	8.8	432

TABLE NO. 5
Comparison of Bricks Made from Various Grades of Ottawa Sand with Bricks Made from the Same Grades of Potomac River Sand Respectively

Grade of Sand	Absorption: Ottawa	Absorption: Potomac	Modulus of Rupture lb. per sq. in.: Ottawa	Modulus of Rupture lb. per sq. in.: Potomac
20-30	11.4	11.0	253	433
30-50	12.7	9.4	285	762
50-70	15.4	10.9	462	1080
70-100	17.2	10.4	494	1302
100-200	18.1	12.2	.....	1291

TABLE NO. 6
Effect of Varying Percentages of Lime with Different Grades of Sand

Composition of Bricks By Weight: Potomac River Sand Pct.	Lime $Ca(OH)_2$ Pct.	Absorption For Sand 16-30 Pct.	Absorption For Sand 100-200 Pct.	Modulus of Rupture lb. per sq. in. For Sand 16-30	Modulus of Rupture lb. per sq. in. For Sand 100-200
90	10	9.2	12.2	504	1291
80	20	11.2	12.3	200	1485
70	30	11.0	13.1	231	1359
60	40	9.4	11.2	575	1412
50	50	9.9	10.9	609	1922
40	60	9.9	10.6	779	1729
30	70	9.8	10.2	1247	1345
20	80	.....	10.4	.....	1474
10	90	.....	11.0	.....	1298

Rate Reduction Activity in Texas

ORGANIZED effort is being made by San Antonio, Tex., architects, construction and materials interests to have the freight rates on materials reduced. Here, as elsewhere, it is believed that the present high rates are holding back building, increasing unemployment and delaying financial recovery.

Already the railroads in Texas are beginning to see the light, for the rates on road-building shell hauled by the Gulf, Colorado and Santa Fe have been included in the reduction made of road-building material. This reduction is between 10 and 15 per cent, although only state and county benefits, not the contractor or the municipalities.

Again the division freight agent of the International & Great Northern at Waco has been advised by Traffic Manager Booth that his road has applied to the railroad commission for authority to apply rates on sand, gravel, crushed stone and shell, carloads, when consigned to county or state officers, based on rates 15 per cent higher than those in effect August 25, 1920. This is also a reduction of between 10 and 15 per cent.

It is also announced that the Texas Railroad Commission has authorized lower rates on road materials to Palestine, for municipal purposes, 50,000-carload minimum, as follows: Crushed stone from Dittlinger and New Braunfels, 7 cents per 100 lb.; sand and gravel from Austin, 6½ cents, and gravel from Marlin, 5½ cents.

Accident Prevention

Good Results from Accident Prevention at Marquette Plant*

By T. F. Halpin, Employment Manager

BELIEVING you are more interested in facts than theories, I shall endeavor to give you a description of the trouble we have had at the Marquette cement plant since we first thought of accident prevention work. At this plant, as at a good many others, we satisfied ourselves for several years with complying with as many of our insurance recommendations as possible. These suggestions were along the lines of a hand railing here, and a belt guard there, etc. While pursuing this method we continued to have almost the same number of accidents from year to year, and as we know now were too many. Whether we had more or less than other member companies on the basis of number of men employed we did not know.

In 1918, Mr. Jacobsen of the Association Bureau of Accident Prevention and Insurance opened our eyes to the fact that we had plenty of room for improvement. It is from this time that our actual accident prevention work can be traced.

First of all, we organized a committee of foremen and it had its regular meeting twice a month. The object was to get the foremen completely sold to our ideas. We had some very good meetings to start with, but gradually ran into trouble and came near losing all the ground we had gained. Our mill was extremely busy with manufacturing and a great deal of construction work and gradually the foreman commenced to excuse themselves from the meetings on the ground that they could not get away from their work. Finally, during the latter part of 1919 and the early part of 1920, things became so confused that no meetings at all were held. The result of this was that during that time we had as many accidents as before we ever started any safety work.

We were convinced that the majority of our accidents could be prevented, as very few of them had anything to do with mechanical equipment. Practically all were traceable to neglect by the workmen or their immediate superiors. Knowing that the majority of our accidents were due to the human element, we finally decided as the last resource to get the regular workmen on the job and to this end we formulated a workmen's safety committee, after having discontinued the foremen's committee. Our foremen were familiarized with our idea and we made sure that we had their co-operation and interest. The workmen's committee soon proved its value and showed us that apparently we had struck out in the right direction.

The principal trouble with a safety committee is that the men have never had an opportunity to analyze the causes of most accidents and consequently the general belief is that guards constitute the only salvation. Our committee, to begin with, devoted entirely too much time to mechanical problems, and while we did not wish to discourage recommendations in respect to guards which were absolutely essential, our main object was to prove to the men that even with the mill in its present shape, by far the greater part of accidents could be prevented through better attention on the part of workmen themselves.

We felt we were somewhat handicapped because we lacked the medium through which we constantly could bring this fact to the attention of the men. For this reason we employed a man as safety engineer (give him any suitable title). He is not an engineer in the full sense of the word, but he is at least a level-headed man who can approach the men on their own ground without stirring up any antagonism and who in his trips through the plant serves as the best advertising medium we have. The duty of this man is to devote all his time to safety activities and nothing else. At first glance it may seem like a job which would not keep a man busy continuously and that may be somewhat costly. Our man is one of the busiest at the plant and we have made a mighty good investment in employing him.

To show how we got along after we had perfected our safety organization, I will ask you to follow me through the period from December, 1920, to May, 1921—five months—and we contend one of the most difficult periods we have ever had, due to the vast amount of construction and repair work and because we had many more men working than at any other period of our existence. After very careful consideration, we finally decided to carry our own compensation insurance beginning December 1, 1920. This decision gave us additional incentive to extra precautions.

During the latter part of November we decided to try a "No Accident Month" campaign at the plant, and designated December for this purpose. We had read a great deal of "No Accident Weeks" in other industries, which usually employed many men, but we thought possibly there would not be enough glory in it for us to go through a period of a week, owing to the small number of men we had, so we then conceived the idea of a "month without an accident." We thought this would be a period that would be of enough length to be worth while. We secured the co-operation of Mr. Jacobsen from the association office and mapped out our plan. We soon came to the conclusion that the best method would be to put the proposition squarely before every employe by explaining through individual letters exactly what we expected to do. On November 30 a multigraphed letter, addressed to the individual and signed in pen and ink by Mr. Moyle, our superintendent, was sent to each man.

Next, it was decided that the question should be so completely advertised all over the plant and mine every day that not one man would lose track of the campaign and forget to be careful at any time. We decided to have special bulletins made, one for every day in the month. These bulletins were attractively printed and we posted them in about every prominent place in the plant.

(To be continued)

*Abstracted from paper read at the spring meeting of the Portland Cement Association, Chicago, 1921.

Editorial Comment

Trade associations are of two kinds. Some are like the old school of diplomats and statesmen. They prefer to conduct their business in executive session—star chamber proceedings. Others believe in open meetings, with newspaper men present; may be with representatives of competitive materials also sitting in—at least not throwing them out. We believe the first-mentioned method of procedure is the more business-like and the more productive of tangible results to members; but we feel certain that the last-named method is far more in keeping with the traditions of our country and with the present trend of world affairs.

For Open Diplomacy

We can't fool all the people all the time. We can't even fool ourselves all the time. Important as our own business may be to us, and essential as our particular industry may seem to us, of far vaster importance and moment is the economy of things in general, and the public welfare. Whoever builds walls around their business, individual or trade association, to keep in what they consider their own, or to keep out what may affect their business, are like the ostrich which sticks his head in the ground to escape his pursuers.

This is the day when it is good policy and good business to receive and assimulate anything and everything that can affect a business, an industry or society in general. This is the day when progressive business men believe they progress faster when they help the industry as a whole to progress; the day when the progressive citizen believes his prosperity is closely related to his city's prosperity and the Nation's.

These thoughts are called forth by two incidents during the past two weeks—the remarks of Frederick L. Cranford at the recent convention of the Associated General Contractors of America and the reported action of the Mississippi Valley Association of Highway Engineers in regard to the price of portland cement.

Users vs. Producers of Portland Cement

Mr. Cranford, who is one of the most prominent general contractors in the United States, speaking of his country-wide tour in behalf of Secretary Hoover's committee on unemployment, said: "The belief of the public with regard to material prices is quite as effective in barring resumption of construction work as any facts should be; and, we have reason to think the belief accords pretty well with the facts. *It is noteworthy that the materials of which the price is most abusively high are the materials which are controlled by national associations which meet behind closed doors, thus creating doubt as to their motives.*" He said more, even less complimentary, but that is sufficient to show the effect of "secret diplomacy" on the minds of even broad-gage business men.

Of course, like all the rest of "us humans," Mr. Cranford is influenced largely by inherently selfish motives. Nevertheless no one rushes forward to defend these associations and the price of their materials. We believe we could successfully defend the price of cement in nearly every instance, whether questioned by Mr. Cranford or the Mississippi Valley Highway Engineers; but cement manufacturers have never taken disinterested persons enough into their confidence that such defense could be based on first-hand knowledge, or even based on an intimate, sympathetic appreciation of their side of the case.

No one begrudges a business or an industry a fair profit, and well informed men, or a well informed general public, gage fair profits not solely by the amount, but by the risks involved and many other factors. And no matter how fair and honorable any group of business men, or any trade association may be, if it meets in secret session, its motives will always be suspected. It has always been so since the foundation of our government—and long before that among people of democratic instincts—and it always will be so. It is fast being recognized that national trade associations are just as much a part of our *de facto* government as is Congress itself—and our government is—and it is to be hoped always will be—a government of the people, by the people and for the people.

Production of their own aggregates, at portable or semi-portable plants alongside the job by highway contractors or highway officials, always has been, now is, and always will be a thorn in the side of commercial producers. To combat this kind of competition two methods of attack are open. One is to approach the contractor or engineer in a spirit of hostility, and either by direct or indirect means, attempt to tell him he is a "dumbell," for having so little sense. The other method is to demonstrate to him with real proof, by tactful methods, that it pays to buy service, quality and responsibility, as well as aggregates.

Side-of-the-Road Competition

No man likes to be reminded he has made a mistake, and certainly none enjoys being called a "dumbell"—literally or by inference. In these enlightened times it is not considered good salesmanship to "knock" your competitors. And we can't recall, in any other industry, when it was ever good salesmanship or good business to "knock" your customers.

We recommend the reading of Harry Brandon's talk before the National Crushed Stone Convention to every producer of aggregates. To our mind, when an industry begins to take account of its deficiencies and shortcomings with a view to rendering greater service, it is on the right road to bigger and better things and on the straightest road to prosperity.

New Machinery and Equipment

Automatic Sand-Settling Tank

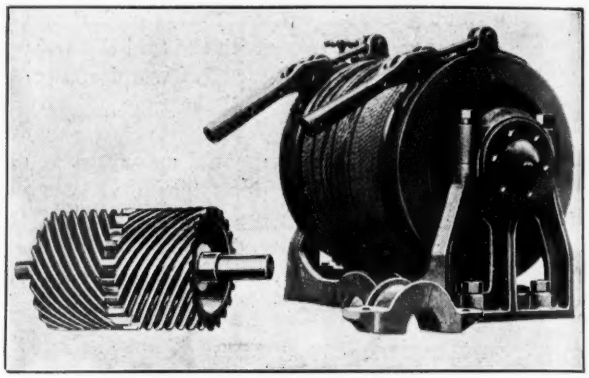
TO conform to the particular needs of sand and gravel washing the Allen Cone Co., El Paso, Tex., has placed on the market during the past year a new type automatic sand tank. In principle this tank is similar to the old Allen sand cone which was described in a previous issue of ROCK PRODUCTS, but the design has been changed to adapt it to the heavy feeds of water and solids encountered in sand and gravel operations.

Automatic sand tank with reduction plate

The new machine has a very delicate float control, which the manufacturers claim will shut the machine off as soon as the feed is off. It is claimed that the float control is not affected by a slight settling of the supporting timbers of the cone, such as seriously affects the work of a tilting cone.

On account of this reliability in the cone or tank, the company recommends it strongly for stock-piling purposes. It can be set as high as is desired to build the stock pile, and if given the feed it will do the work without any especial attention. By installing it on a truck mounting which runs on rails on a trestle, the stock pile can be built to any reasonable length.

As a means for varying the classification the sand tank is equipped with a reduction plate, thus giving the operator an opportunity to regulate the amount of fine sand that settles and grade the sand as desired. It is also employed where it is desired to separate the sand into two products such as mason sand and concrete sand. The adjustment is made easily and rapidly and it can be adapted to changes in the feed as it comes from the bank or used to make more or less fine sand, according to the demands of the market.



Portable "Turbinair" hoist and rotor

Portable Hoisting Engine

A PORTABLE hoisting engine suitable for use in quarries, pits, shops, etc., has been developed by the Sullivan Machinery Co., Chicago, Ill. It is known as the Sullivan Turbinair hoist.

The company announces that this type hoist may be mounted on a cross bar or column in a shaft, winze or raise, for handling drills, steel or timbers; it may be bolted to a timber or girder or to a wall or floor, for pulling cars and any odd jobs of hoisting or hauling. Its capacity is 1500 lb. dead load lifted vertically at 100 ft. per min., under 80 lb. air pressure; it weighs 285 lb. and its drum will accommodate a maximum of 500 ft. of 5/16-in. wire rope.

The hoist consists of a cylindrical drum, mounted on a steel frame and completely enclosing the operating mechanism. This comprises the Turbinair motor, and reduction gearing which drives the drum shell.

The hoist has two rotors provided with right- and left-hand helical flutes or vanes converging to a spur tooth in the center, the rotors meshing as they revolve under the influence of the incoming air. The hoist has a friction clutch and brake and when both of these are released the rope may pull freely from the drum. The friction clutch may be locked in position and the load raised or lowered, controlled entirely by a throttle valve. The brake is of the hand type and will hold any load within the hoist capacity. Air is admitted at the axis of the drum through a hollow shaft and the motor revolves with the drum.

Rubber Dredging Sleeve

A RUBBER dredging sleeve has been placed on the market by the New York Rubber Co., 84 Reade street, New York, which can be used as a flexible joint on pontoon pipe lines or the discharge end of dredging machines, permitting easy riding on the water surface.

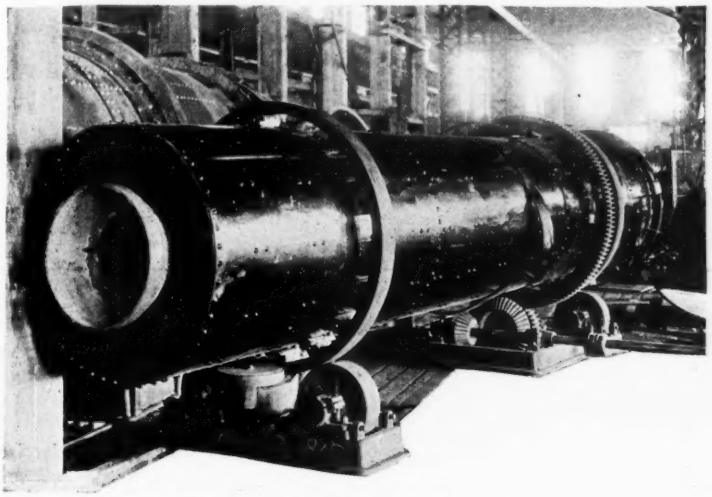
Because of pressure used for discharging sand and gravel through the pontoon pipe, dredge sleeves are subjected to considerable expansion. The company uses a specially constructed cotton duck having the same number of threads per inch in the warp and filler directions with the latter having a distinct wave or crimp, the same as contained in the warp, that permits proper expansion.

The inner rubber tube is made of a ¼-in. compound that withstands the cutting, grinding action of the sand and gravel. The plies of duck are firmly pressed together after being treated with a rubber friction and a layer of rubber in addition is placed between each ply; then a heavy rubber cover is placed over the outside and the ends securely capped with rubber so that no moisture can get into it. This newly constructed dredge sleeve is said to have given continuous service for more than a year.

Drier for Reducing Dust Loss

ONE recent change in the construction of the Ruggles-Coles drier, announces the Ruggles-Coles Engineering Co., New York, is that the new construction of the lifting blades within the drier has made it possible to keep the dust down and at the same time create a uniform showering effect. Manholes are now placed in various parts of the outer shell, making the space where the material is being dried readily accessible.

The cyclone type dust collector still further reduces the dust loss even when drying fine materials, tests having shown efficiencies of better than 90 per cent on fine materials.



Ruggles-Coles improved drier

Compressed-Air Hoist Engine

THE Model 250 Waughoist engine, developed by the Denver Rock Drill Manufacturing Co., Denver, Colo., is generally adapted for such work as is required from a small hoisting engine in quarry and gravel operations.

The Waughoist engine is a rotary engine, the principal parts being a motor housing, distributor, cylinder block, spider, spider shaft and pistons. The sectional view in the illustration shows the various parts in relation to each other.

The whole engine revolves within a motor housing, an oil and air-tight casting which protects the engine from the atmosphere and also serves as an oil reservoir.

The distributor, through which air is supplied to the cylinder, is a hardened and ground stationary steel shaft, serving as a power distributor and cylinder block support.

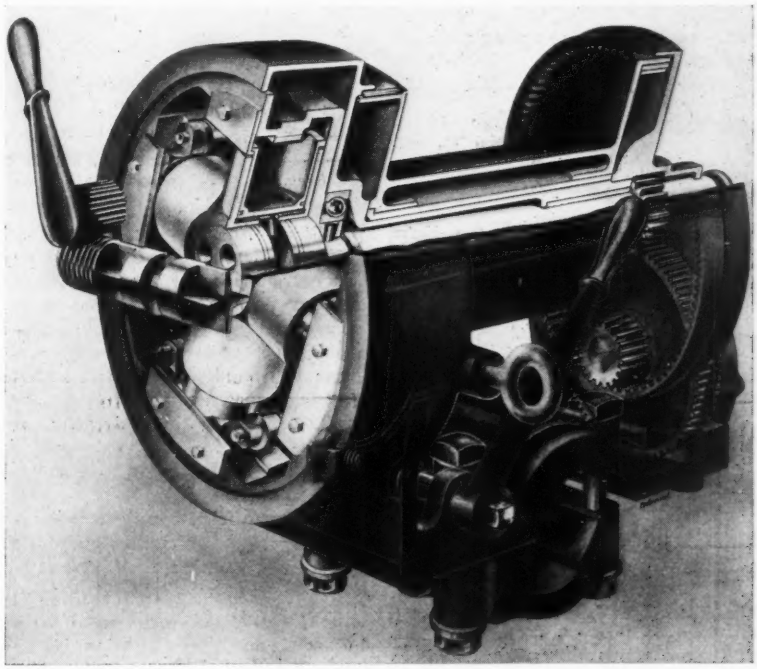
The company also claims that in the Waughoist all connecting rods and crossheads are eliminated. There are two rotary elements: The block has four cylinders, cast integral and spaced 90 deg. apart, mounted on a stationary axis through which air is supplied to and exhausted from the cylinders by ports; the spider—which may be likened to the crank and shaft on the conventional engine—is a hollow box having four flats around the inside perimeter to take the thrust exerted by the pistons. Integral with the large portion is a shaft supported in suitable bearings. The spider axis is parallel with but eccentric to the axis about which the cylinder block revolves.

When the bottom opening of one cylinder registers with the live air port in the axle a pressure is exerted against the piston which transmits a thrust directly against the corresponding flat on the inner side of the spider. A rotary motion of the spider carries the cylinder block and pistons with it. After passing through 180 deg. of the cycle the cylinder registers with the exhaust port in the axle. In the meantime the opposite cylinder is exerting power, thus there is always one cylinder in full action.

Instead of connecting rods the pistons have rollers which permit transverse motion to the spider flats, at the same time reducing the friction. These rollers are constantly in contact with the spider, being held there by centrifugal action. When the engine is at rest a plate engages with a tongue along the lower edge of the piston.

Such construction is adapted to a splash-oiling system and permits of high speeds without vibration. All engine parts run in an oil bath and the reciprocating parts are carefully balanced. The volumetric displacement of the pistons is low in comparison with the power delivered, with a resulting economy of air with either light or heavy loads.

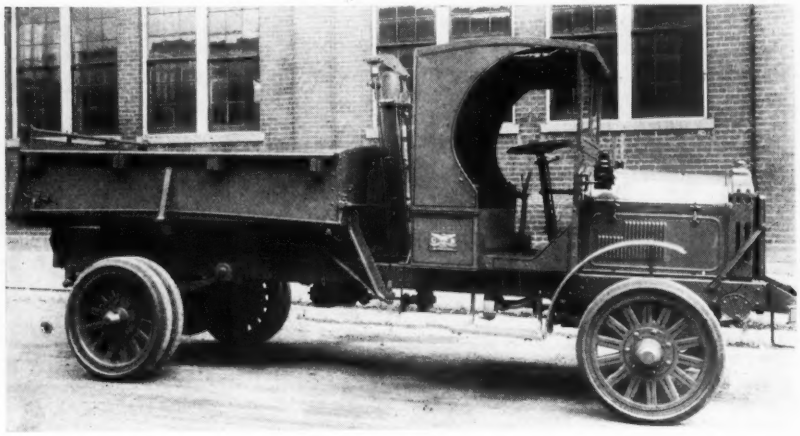
The Waughoist is of 5 h.p. at 100 lb. pressure; the hoisting capacity, 500 to 2000 lb. at 68 to 143 ft. per min; 755 cu. ft. of rope space accommodates 1000 ft. of ¼-in. rope, 465 ft. of ⅜-in. rope, 225 ft. of ½-in. rope. The engine fits either a 4 or a 4½-in. column.



Sectional view of model 250 Waughoist

Four-Ton Hoisting Motor Truck

A MOTOR truck of 8000 lb. capacity, power take-off and steel dump body (shown in the illustration) has been put on the market by the United States Motor Truck Co., Cincinnati, Ohio.



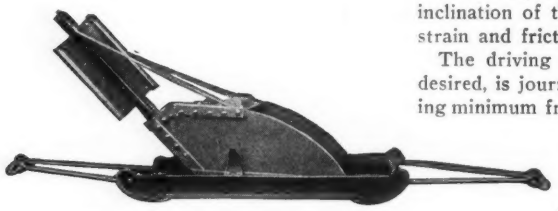
Model S motor truck of 8,000-lb. capacity, equipped with steel cab and steel dump body

The steel-dump bodies can be made with double-acting tailgate—opened at the bottom or at the top as desired. The tailgate is operated entirely from the driver's seat at any distance, thus providing an efficient means for spreading road material, etc.

Bottomless Bucket for Handling Sand and Gravel

THE Beach bottomless bucket, announces the manufacturer, the Beach Mfg. Co., Charlotte, Mich., is designed to remove gravel from below water surface equally as well as from a dry bank, and is also efficient in stripping and excavating; it will load directly into wagons or trucks.

In operation the bucket is drawn forward and backward by two cables, the bucket being so constructed that with ordinary material it will fill in traveling 12 ft. When filled, the material striking the slanting top carries up the bucket, thus preventing it from digging in and causing waste of power.



Bottomless bucket in dumping position

To unload the bucket, the pull-back cable is started and the bucket backed away from the load. By moving the sheave block on the chain at the rear of the pit a wide strip can be excavated without change of anchorage.

This bucket is made with removable chilled shoes and reversible cutting bit and can be set like a plow to penetrate hard material. By tightening up on the pull-back the bucket will stand endwise and unload sticky material. By inserting two bolts the bucket can be made rigid.

Crushing and Grinding Machinery Developments

A GEARLESS crusher, heavy-duty balanced slugger rolls and an air-swept combination ball and tube mill have been developed during the past year by the Kennedy-Van Saun Mfg. and Engineering Corp., 120 Broadway, New York City.

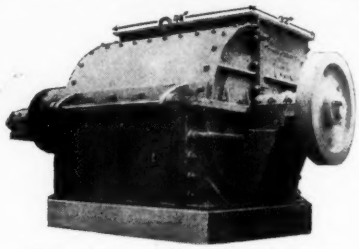
The gearless crusher has been described in a previous issue of ROCK PRODUCTS. The company claims that this crusher does away with gear speed limitations, thus making a large increase in the number of blows delivered. A ball and socket eccentric compensates for all changes in the inclination of the shaft and avoids undue strain and friction.

The driving pulley or rope sheave, as desired, is journaled on ball bearings, giving minimum friction and maximum power transmission to the eccentric.

The heavy-duty balanced slugger rolls were developed for big producing plants where trouble was encountered with gyratory crushers on account of pieces of steel or iron entering the crusher, as in crushing slag; in cement plants where difficulty is had in secondary crushing, due to the packing of clay in the discharge openings during wet seasons. The slugger rolls have heavy knobs or sluggers cast on the face and staggered so that they act as pulverizers of the large pieces. Heavy springs are placed at each end of the machine, set at the proper tension for the material to be crushed. Foreign substances, such as steel, will spread the rolls, thereby avoiding a serious mishap. The rolls are run at a peripheral speed of 900 r.p.m. with power consumption.

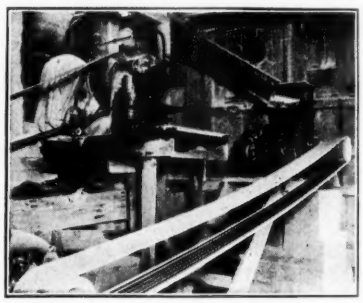
Quarry Crusher and Pulverizer

THE illustrations show a Gruendler, manufactured by the Gruendler Patent Crusher and Pulverizer Co., St. Louis, installed in a prominent stone quarry,



Gruendler crusher and pulverizer

crushing over-sized rock to ¾ in. and ¼ in. screenings, eliminating a disc crusher. This machine can also be quickly adjusted for crushing for road work or to the fineness of agricultural limestone for fertilizing. The company claims that these installations are replacing gyratory jaw



Quarry installation

or disc crushers in the leading quarries throughout the country—due to its low cost of maintenance and adjustable features for crushing to any fineness desired. It is manufactured in sizes to take quarry run rock, crushing to the desired fineness in one operation.

Sanitary Collapsible Barrel

A NEW, collapsible, sanitary barrel for handling lime, cement, etc., has been put on the market by the Sanitary Collapsible Barrel Co., Pittsburgh, Pa., called the San-Co-Bar barrel. It is drum-shaped in body, of three-ply sweet-gum veneer, with two halfround galvanized hoops fastened by a patented device, and having galvanized steel heads. It is claimed that 1250 barrels can be shipped, knockeddown, in one car. It can be assembled in 5 min., and all parts are standardized.

New Engineering Service for Rock Products Industries

EXPERT advice on problems of construction, operation and business—a combination of engineering and business service—is the aim of Waller Crow, Inc. The utility of service along these lines has been demonstrated in many other industries and it is felt that the rock products industries are as much in need of all-round engineering advice as any.

No enterprise can be successful to a very great degree unless all facts available for successful operation of the plant have been taken into consideration at every stage of the engineering and construction work. So it is the plan of this organization, because of the vast mass of technical data available for every industry, to give expert service by picking out fundamentals or evolving the fundamentals from the mass, and applying them to a particular industrial operation with the commercial side at all times in view.

That such ideas have a very fertile field, in this age of over-specialization, has been well proven; and this attitude toward common sense and analytical engineering, it is believed, will continue to show results in successful operation. Mr. Crow considers that too much attention has been given by various organizations to the purely technical side of manufacturing problems, thus losing sight of other factors that are equally important.

The selection of proper machinery and other equipment to accomplish any given work in the most economical and efficient manner, will receive careful consideration by this new firm, it is announced. Their policy in this regard, Mr. Crow says, is to the effect that the American manufacturer has produced everything necessary for any mechanical operation and that all "cure-alls" or revolutionary ideas should be approached with extreme care and viewed from an entirely practical standpoint.

Waller Crow, Inc., is a corporation duly organized with general offices at 327 South La Salle street, Chicago, and headed by Waller Crow, Pittsburgh, Pa., who has a wide acquaintance in various manufacturing and engineering lines. Mr. Crow's experience has been varied and instructive, and has included both plant operation and exploratory work in practical geology. He received his education in the St. Louis High Schools, supplemented by three years in the Southern Illinois Normal University. Subsequently he was in the banking business and in Southwest lumber operations. He has been identified in an executive capacity with such concerns as the Big Muddy Coal & Iron Co., the Bessemer Washed Coal Co., the Carterville Mining Co., and the Manufacturers Fuel Co. He has also been consultant to several of the largest manufacturers in the East. He was general manager of the Benton Brick Co. and consulting engineer for the Hocking Valley Products Co., operating the largest face brick plant in Ohio. He has taken part in various geological surveys of the Appalachian, Piedmont, Rocky and Cascade ranges. He has had much experience in the manufacture and application of heavy-duty machinery.

Waller Crow

Mr. Crow needs no introduction to the rock products industry, in view of his recent work as an official of the Schaffer Engineering and Equipment Co. By reason of his operating exeperience and consulting work in the ceramic field, he is a member of the American Ceramic Society, as well as other technical organizations.

Standard Cement Sieves

DURING 1921 the cement section of the Bureau of Standards standardized 173 No. 200 cement sieves as compared with 56 standardized in the fiscal year 1920 and 56 in 1919. This is an increase of over 200 per cent. It is believed that no difficulty should be experienced in obtaining No. 200 sieves meeting the standard specifications.

The Bureau has also developed specifications for a new series of standard testing sieves. In connection with the standardization of these sieves the present specifications are based only upon average measurements of openings and wire diameters, with certain tolerances upon these averages and upon the maximum openings. It is recognized, however, that appreciable differences in sieving values of sieves meeting these specifications will exist, particularly in the finer sieves, and data will be obtained as the new sieves come into general use as to the magnitude of these differences in sieving values and the need of correction factors to be applied whenever results of the highest accuracy are required. At present, correction factors are determined only for No. 200 sieves submitted for standardization, the standard cement fineness sample being used. It is planned eventually to prepare standard samples whereby correction factors may be determined for sieves finer and coarser than the No. 200 in the U. S. standard sieve series.

Sieves may now be obtained from two manufacturers that are made according to the U. S. standard sieve series and a third manufactures a series of testing sieves of which the majority nominally conform to these specifications.

The Bureau prepares and keeps on hand for issue standard fineness samples of cement for checking up No. 200 sieves. They are supplied in two degrees of fineness and are issued in sealed glass jars, each jar containing about 160 g., enough for three 50 g. sieve tests. Each sample is accompanied by full directions for its use. A nominal price of 50 cents, sufficient only to cover the cost of preparation, is charged for each sample. With these samples No. 200 sieves may be compared with the Bureau's standards and correction factors obtained. These samples are also used by the Bureau in checking up its own sieves and in the standardization of No. 200 sieves submitted for certification. The two samples on hand at 46g-78 per cent passing the No. 200 sieve and 47c-89 per cent passing the No. 200 sieve.

Frisco Asks to Reduce Sand and Gravel Rate

AN application for authority to reduce the freight rate of 67½ cents a ton on sand and gravel to 50 cents a ton will be filed with the Interstate Commerce Commission by the St. Louis-San Francisco railroad, according to President J. M. Kurn. He has stated, it is reported, that the reduction is sought to assist in stimulating building.

The Rock Products Market

Wholesale Prices of Crushed Stone

Prices given are per ton, F. O. B., at producing plant or nearest shipping point

Crushed Limestone

City or shipping point	Screenings, ¼ inch down	½ inch and less	¾ inch and less	1½ inch and less	2½ inch and less	3 inch and larger
EASTERN:						
Blakeslee, N. Y.	1.00	1.00	1.00	1.00	1.00	.....
Buffalo, N. Y.	1.50 per net ton all sizes—Winter prices from stock					
Burlington, Vt.	1.00	.....	2.50	2.00	2.00	.....
Chaumont, N. Y.	.....	.....	1.75	1.25	1.25	1.25
Cobleskill, N. Y.	1.25	1.25	1.25	1.25	1.25	.....
Coldwater, N. Y.	1.50 per net ton, all sizes					
Eastern Penna.	.75	1.60	1.60	1.60	1.60	1.60
Munns, N. Y.	.70	1.15	1.15	1.15	1.15	1.15
Western New York	.70	1.25	1.25	1.25	1.25	1.25
CENTRAL						
Alden, Ia.	.80@1.00	.80@1.00	1.50	1.45	.....	.....
Alton, Ill.	2.00	.....	1.50	1.35	1.35	.....
Bettendorf, Ia.	All sizes, 2.00 cu. yd. f.o.b. quarry					
Buffalo, Iowa	1.00	1.50	1.40	1.30	1.35	1.35
Chicago, Ill.	1.20	1.60	1.20	1.20	1.20	1.20
Dundas, Ont.	1.00	1.35	1.35	1.35	1.10	1.10
Greencastle, Ind.	1.25	1.10	1.00	1.00	1.00	1.00
Illinois, Southern	1.75	1.60	1.50	1.50	1.40	.....
Kokomo, Ind.	1.10	1.25	1.25	1.10	1.10	1.10
Krause or Columbia, Ill.	1.40	1.25	1.25	1.10	1.10	1.10
Lannon, Wis.	.90	1.00	1.00	1.00	1.00	1.00
Marblehead and Brillion, Wis.	1.10	.....	1.20	1.10	1.10	.....
Montrose, Ia.	1.35@1.50	1.60	1.50@1.60	1.60	1.50	1.50
River Rouge, Mich.	1.00	1.15	1.15	1.15	1.15	1.00
Sheboygan, Wis.	1.00	1.10	1.10	1.10	1.10	.....
Southern Illinois	1.50	1.40	1.40	1.35	1.35	.....
Stolle, Ill. (I. C. R. R.)	1.55	1.55	1.55	1.30@1.35	1.50	1.50
Stone City, Iowa	.75	.....	1.40	1.35	1.30	.....
Toledo, Ohio	1.84	1.99	1.99	1.99	1.84	1.84
Toronto, Canada	1.90	2.25	2.25	2.25	2.00	2.00
Valmeyer, Ill.	1.60	1.30	1.30	1.30	1.30	1.30
Waukesha, Wis.	all sizes 1.10 per ton					
SOUTHERN:	These prices include 90c freight					
Cartersville, Ga.	.....	2.00	.....	1.45	1.45	.....
Chickamauga, Tenn.	1.00	.80	.80	.80	.70	.65
Dallas, Texas	1.10	1.25	1.25	1.25	1.10	1.10
Ft. Springs, W. Va.	1.20	1.50	1.75	1.60	1.45	1.30
El Paso, Tex.	1.00	1.00	1.00	1.00	1.00	.....
Gainesville, Ga.	1.00	1.25	1.25	1.25	1.25	1.25
Garnet and Tulsa, Okla.	.50	1.60	1.60	1.45	1.45	.....
Ladds, Ga.	2.00	2.00	2.00	1.50	1.50	1.50
Morris Spur (near Dallas) Tex.	1.10	1.25	1.25	1.25	1.25	1.25
Portland, Ga.	.60@1.00		(All other sizes 1.00@1.25)			
Shephard, Tenn.	1.00@1.25	1.00@1.25	1.00@1.25	.75@1.00	.75@1.00	.....
WESTERN:						
Atchison, Kans.	.50	2.10 (Rip-rap.	2.10	2.10 1.80 per ton)	2.10	2.10
Blue Springs and Wymore, Neb.	.20	1.65	1.65	1.55	1.45	1.40
Cape Girardeau, Mo.	1.50	.....	1.50	1.50	1.25	.....
Kansas City, Mo.	1.00	1.80	1.80	1.80	1.80	1.80

Crushed Trap Rock

City or shipping point	Screenings, ¼ inch down	½ inch and less	¾ inch and less	1½ inch and less	2½ inch and less	3 inch and larger
Baltimore, Md.	1.25	2.50	2.35	2.25	2.00@2.25	2.00
Bernardsville, N. J.	2.00	2 20	2.00	1.80	1.50	.....
Branford, Conn.	.60	1.50	1.25	1.15	1.10	.....
Bound Brook, N. J.	2.00	2.30	2.00	1.70	1.60	.....
Dresser Jct., Wis.	1.25	2.25	2.25	1.75	1.50	.....
Duluth, Minn.	.75@1.00	2.25	1.90@2.00	1.50	1.35@1.50	1.35@1.50
Dwight Station, Calif.	.75@1.00—all sizes					
E. Summit, N. J.	2.10	2.35	2.15	1.75	1.75	.....
Eastern Mass.	.60	1.95	1.75	1.50	1.50	1.50
Eastern New York	1.00	1.80	1.70	1.50	1.50	1.50
Eastern Penna.	1.25	1.80	1.70	1.60	1.50	1.50
New Britain, Middlefield, Rocky Hill, Meriden, Conn.	.60@ .80	1.60@1.75	1.50	1.25	1.10	.....
Oakland, Calif.	1.75	1.75	1.75	1.50	1.50	1.50
Richmond, Calif.	.50*	.....	1.75*	1.50*	1.50*	.....
San Diego, Calif.	.50@ .70	1.45@1.75	1.40@1.70	1.30@1.60	1.25@1.55	1.25@1.55
Springfield, N. J.	2.35	2.60	2.40	2.00	1.75	1.75
Westfield, Mass.	.60	1.35	1.30	1.20	1.10	.....

Miscellaneous Crushed Stone

City or shipping point	Screenings, ¼ inch down	½ inch and less	¾ inch and less	1½ inch and less	2½ inch and less	3 inch and larger
Alexandria Bay, N. Y.	1.60	.....	1.30	1.50	1.20	.....
Columbia, S. C.—Granite	.75	.....	2.75	2.50	2.35	.....
Dell Rapids, S. D.—Granite	.75	1.85	1.75	1.70	1.70	.....
Dundas, Ont.—Flint	1.00	1.50	1.50	1.50	1.25	1.20
Eastern Penna.—Sandstone	1.00	1.75	1.75	1.50	1.50	1.50
Eastern Penna.—Quartzite	.90	1.60	1.40	1.30	1.30	1.30
Holton, Ga.—Granite	.40	.....	2.50	2.25	2.25	2.00
Lohrville, Wis.—Cr. Granite	1.35	1.40	1.30	.....	1.20	.....
Los Angeles, Cal.—Granite	.....	1.25@1.50	1.15@1.40	1.15@1.40	.....	.....
Macon, Ga.—Granite	.50	.....	2.50	2.25	2.00	1.25@1.90
Middlebrook, Mo.—Granite	3.00@3.50	.....	2.00@2.25	2.25@2.80	.....	1.25@1.50
Red Granite, Wis.	1.35	1.40	1.30	1.50	1.20	.....
Sioux Falls, S. D.—Granite	.75	1.85	1.75	1.70	1.70	.....
Stockbridge, Ga.—Granite	.50	2 00	1.90	1.75	1.75	.....
Utley, Wis.—Red Granite	1.35	1.40	1.30	.....	1.20	.....

*Cubic yard. †Agrl. lime. ||R. R. ballast. §Flux. ‡Rip-rap. a 3-inch and less.

Agricultural Limestone

EASTERN:

Chaumont, N. Y. — Analysis, 95% $CaCO_3$, 1.14% $MgCO_3$ — Thru 100 mesh; sacks, 4.00; bulk 2.50

Coldwater, N. Y.—Analysis, 56.77% $CaCO_3$, 41.74% $MgCO_3$, 70% thru 200 mesh, 95% thru 50 mesh, sacks 4.00; bulk 3.00

Grove City, Pa. — Analysis, 94.89% $CaCO_3$, 1.50% $MgCO_3$—100% thru 20 mesh, 60% thru 100 mesh, 40% thru 200 mesh; in 80 lb. paper sacks, 4.50; bulk 3.00

Hillsville, Pa.—70% thru 100 mesh; sacks, 4.75; bulk 3.00

Jamesville, N. Y. — Analysis, 89.25% $CaCO_3$, 5.25% $MgCO_3$; sacks, 4.50; bulk 2.75

New Castle, Pa.—89% $CaCO_3$, 1.4% $MgCO_3$—75% thru 100 mesh, 84% thru 50 mesh, 100% thru 10 mesh; sacks, 4.75; bulk 3.00

Texas, Md.—Analysis, 58.02% $CaCO_3$, 37.3% $MgCO_3$—50% thru 50 mesh; bags, 4.25; bulk 2.50

Waltord, Pa. — 50% thru 100 mesh, 60% thru 50 mesh, 100% thru 10 mesh; sacks, 4.75; bulk 3.00

West Stockbridge, Mass., Danbury, Conn., North Pownal, Vt.—Analysis, 90% $CaCO_3$—50% thru 100 mesh; paper bags, 5.00—cloth, 5.25; bulk.. 3.50

Williamsport, Pa. — Analysis, 88-90% $CaCO_3$, 3-4% $MgCO_3$—50% thru 50 mesh; paper, 5.00; bulk..... 3.75

CENTRAL:

Alton, Ill. — Analysis, 96% $CaCO_3$, 0.3% $MgCO_3$—90% thru 100 mesh.... 7.75

Bedford, Ind. — Analysis, 98.5% $CaCO_3$, .5% $MgCO_3$—90% thru 10 mesh ..... 1.60@2.00

Belleville, Ont. — Analysis, 90.9% $CaCO_3$, 1.15% $MgCO_3$—45% to 50% thru 100 mesh, 61% to 70% thru 50 mesh; bulk 2.50

Buffalo, Ia.—90% thru 4 mesh..... 1.00

Cape Girardeau, Mo.—Analysis, 93% $CaCO_3$, 3.3% $MgCO_3$ (90% thru 50 mesh, 2.00), 50% thru 4 mesh..... 1.50

Chicago, Ill.—Analysis, 53.63% $CaCO_3$, 37.51% $MgCO_3$—90% thru 4 mesh... 1.00

Columbia, Ill., near East St. Louis—½-in. down ..... 1.25@1.80

Detroit, Mich.—Analysis, 88% $CaCO_3$, 7% $MgCO_3$—75% thru 200 mesh, 2.50@4.75—60% thru 100 mesh..... 1.80@3.80

Elmhurst, Ill. — Analysis, 35.73% $CaCO_3$, 20.69% $MgCO_3$—50% thru 50 mesh 1.25

Greencastle, Ind. — Analysis, 98% $CaCO_3$—50% thru 50 mesh..... 2.00

Krause and Columbia, Ill.—Analysis, 90% $CaCO_3$, 90% thru 4 mesh..... 1.40

Lannon, Wis.—Analysis, 54% $CaCO_3$, 44% $MgCO_3$—90% thru 50 mesh..... 2.00

Marblehead, O.—Analysis, 83.54% $CaCO_3$, 14.92% $MgCO_3$—52.4% thru 100 mesh, 59% thru 50 mesh, 100% thru 4 mesh; sacks, 4.75; bulk..... 3.00

Limestone screenings; bulk..... 1.50

McCook, Ill.—Analysis, 54.10% $CaCO_3$, 45.04% $MgCO_3$—100% thru ¼-in. sieve, 78.12% thru No. 10, 53.29% thru No. 20, 38.14% thru No. 30, 34.86% thru No. 50, 22% thru 100 1.50

Milltown, Ind. — Analysis, 91.59% $CaCO_3$, 4.87% $MgCO_3$—33.6% thru 100 mesh, 40% thru 50 mesh..... 1.25@1.65

Mitchell, Ind. — Analysis, 97.65% $CaCO_3$, 1.76% $MgCO_3$ — 60% thru 100 mesh, all thru 10 mesh..... 1.25

Montrose, Ia.—90% thru 100 mesh..... 1.35

Narlo, Ohio—Analysis 56% $CaCO_3$, 43% $MgCO_3$, limestone screenings, 37% thru 100 mesh; 55% thru 50 mesh; 100% thru 4 mesh..... 1.50@2.00

Ohio (different points), 20% thru 100 mesh; bulk ..... 1.25@1.50

Piqua, O. — Analysis, 82.8% $CaCO_3$, 8.2% $MgCO_3$; neutralizing power in cerms of calcium carbonate, 95.3%—80% thru 100 mesh..... 3.25@5.00

50% thru 50 mesh..... 2.00

River Rouge, Mich. — Analysis, 54% $CaCO_3$, 40% $MgCO_3$; bulk..... .80@1.40

Stolle, Ill., near East St. Louis on I. C. R. R. — Thru ⅛-in. mesh — Analysis, 89.61% to 89.91% $CaCO_3$, 3.82% $MgCO_3$ 1.75

Stone City, Ia.—Analysis, 98% $CaCO_3$, 50% thru 100 mesh..... .75

(Continued on next page)

Agricultural Limestone

(Continued from preceding page.)

Toledo, Ohio—¼-in. to dust, 20% thru 100 mesh 1.50
Waukesha, Wis.—No. 1 kiln dried..... 2.00
No. 2 Natural..... 1.75
Yellow Springs, Ohio—Aanlysis 96.08% $CaCO_3$, 63% $MgCO_3$, 32% thru 100 mesh; 95.57%, sacked, 6.00; bulk.... 4.25
SOUTHERN:
Barber, Va.—Analysis, 92 to 98% $CaCO_3$—Bags, 6.50; bulk..... 4.50
Blowers, Fla.—Analysis, 98% combined carbonates—75% thru 200 mesh..... 4.75
Cape Girardeau, Mo. — Analysis, 93% $CaCO_3$, 3.5% $MgCO_3$ — 50% thru 100 mesh 2.00
90% thru 4 mesh..... 1.50
Cartersville, Ga.—Analysis, all thru 10 mesh ..... 2.00@2.50
Claremont, Va. (Marlime) — Analysis, 90% $CaCO_3$, 2% $MgCO_3$—(90% thru 100 mesh, $4.00), 50% thru 100 mesh 3.50
Dittlinger, Tex. — Analysis, 99.09% $CaCO_3$, .04% $MgCO_3$—90% thru 100 mesh ..... 2.00@3.00
90% thru 4 mesh ..... 1.00@2.00
Ft. Springs, W. Va.—50% thru 100 mesh 3.00
Grevania, Ga.—Analysis, 95% $CaCO_3$, no $MgCO_3$—50% thru 100 mesh..... 2.50
Hot Springs, N. C.—Agricultural limestone; sacks, 4.25; bulk..... 3.00
Knoxville, Tenn.—Pulverized 2.50
90% thru 100 mesh..... 2.00
90% thru 50 mesh..... 1.50
Ladds, Ga.—90% thru 50 mesh..... 2.00
Linnville Falls, N. C.—Analysis,, 53% $CaCO_3$; 42% $MgCO_3$—50% thru 100 mesh; sacks, 4.50; bulk..... 3.00
Mascot, Tenn.—Analysis 52% $CaCO_3$, 38% $MgCO_3$—80% thru 100 mesh.... 3.00
All thru 10 mesh..... 2.50
80% thru 200 mesh..... 4.50
Paper bags, $1.50 extra per ton; burlap, $1.00 extra per ton.
Maxwell, Va. 2.50
Ocala, Fla. — Analysis, 98% $CaCO_3$—75% thru 200 mesh..... 4.50
WESTERN:
Colton, Calif.—Analysis, 90.95% $CaCO_3$, 2-3% $MgCO_3$—all thru 14 mesh—bulk Sacks, 15c extra, returnable. 4.00
Garnett, Okla.—Analysis, 86% $CaCO_3$, 50% thru 4 mesh ..... .50
Kansas City, Mo., Corrigan Sid'g—50% thru 100 mesh; bulk..... 1.80
Terminous, Calif. — Analysis, 97.3% $CaCO_3$, .04% $MgCO_3$—65% thru 200 mesh, 90% thru 100 mesh, 95% thru 80 mesh, 100% thru 50 mesh; sacks, 5.00; bulk 4.50
Tulsa, Okla.—90% thru 4 mesh..... .50

Miscellaneous Sands

Silica sand is quoted washed, dried and screened unless otherwise stated.

GLASS SAND:
Baltimore, Md. ..... 2.25@2.75
Berkley Springs, W. Va..... 2.00@2.25
Cedarville and South Vineland, N. J.—Damp, 1.75; dry..... 2.25
Cheshire, Mass. ..... 5.00@7.00
Hancock, Md.—Damp ..... 2.50@3.50
Klondike and Pacific, Mo..... 2.00@2.50
Mapleton, Pa.—Dry 2.50
Damp 2.00
Massillon, Ohio 3.00
Millington, Ill. 1.75
Mineral Ridge, Ohio..... 2.50@3.00
Montoursville, Pa.—Green, washed..... 2.00
Oregon, Ill.—Large contracts..... 1.75
Ottawa, Ill. ..... 1.25@1.50
Pittsburgh, Pa.—Dry, 4.00; damp..... 3.00
Rockwood, Mich. 2.75
Round Top, Md.—(washed-screened).... 1.25
St. Mary's, Pa.—Unwashed..... 2.25
Thayers, Pa.—Washed 2.00
Utica, Ill. ..... 1.25@1.75
Zanesville, Ohio ..... 2.00@2.50

FOUNDRY SAND:
Albany, N. Y.—Sand blast..... 4.00
Molding fine, coarse and brass..... 2.25@2.50
Allentown, Pa.—Core and molding fine 1.50@1.75
Arenzville, Ill.—Molding fine..... 1.40@1.60
Beach City, O. — Core, washed and screened ..... 2.00@2.50
Furnace lining ..... 2.50@3.00
Molding fine and coarse..... 2.25@2.50
Bowmantown, Pa.—Core ..... 1.35@1.50
Molding, coarse ..... 1.80@2.00
Cleveland, O.—Molding coarse..... 1.50@2.00
Brass molding ..... 1.50@2.00
Molding fine ..... 1.50@2.25
Core ..... 1.25@1.50
Columbus, O.—Core ..... .30@1.25
Sand blast ..... 4.50@5.00
Furnace Lining 2.00
Molding fine ..... 2.00@2.75
Molding coarse ..... 1.75@2.50
Stone sawing 1.50
Traction 1.00
Brass molding 2.75

(Continued on next page)

Wholesale Prices of Sand and Gravel

Prices given are per ton, F. O. B., at producing plant or nearest shipping point

Washed Sand and Gravel

City or shipping point	Fine Sand, 1/10 inch down	Sand, ¼ inch and less	Gravel, ½ inch and less	Gravel, 1 inch and less	Gravel, 1½ inch and less	Gravel, 2 inch and less
EASTERN:						
Ambridge and So. Heights, Pa.	.....	1.15	1.15	1.15	.70	.70
Attica, N. Y.	.75	.75	.75	1.00	1.00	1.00
Buffalo, N. Y.	1.10	.95	.85	.....	.85	.....
Erie, Pa.	.....	1.00	.....	1.15	.....	1.25
Farmingdale, N. J.	.....	1.00	.....	.....	.....	.....
Hartford, Conn.	.90	.....	1.25	1.15	1.15	1.15
Leeds Junction, Me.	.....	.50	1.75	1.50	1.35	1.25
Ludlow, Mass.	.75•	.75•	1.70	.....	1.50•	1.50•
Philadelphia, Pa.	.75	.75	.....	1.40	1.25	.....
Pittsburgh, Pa.	.....	1.30	1.30	1.30	.85	.85
Portland, Maine	.....	.50	1.75	.....	1.35	1.35
Texas, Md.	.....	1.00	.....	Pure white sand, 1.50		
Washington, D. C.	.75	.75	2.00	1.40	2.00	2.00
CENTRAL:						
Alton, Ill.	.....	.85	.....	.....	.....	.....
Anson, Wis.	.50	.50	.....	.....	.....	.90
Attica and Covington, Ind.	.90	.90	.90	1.00	1.00	1.00
Barton, Wis.	.....	.60	.70	.70	.70	.70
Beloit, Wis.	.....	.50	.....	.....	.50	.....
Chicago, Ill.	.....	1.75@2.23	1.75@2.43	.....	.....	.....
Cincinnati, Ohio	.70	.65	.90	.90	.90	.90
Columbus, Ohio	.80@1.00	1.00@1.25	1.00@1.25	1.00@1.25	1.00@1.25	100@1.25
Des Moines, Ia.	.....	.40@ .65	1.60	1.60	1.60	1.60
Detroit, Mich.	.65	.65	.95	.95	.95	.95
Earlestead (Flint), Mich.	.70	60-40 sieves, .85; Pebbles, .95				
Eau Claire, Wis.	.40	.....	1.25	.....	.90	.....
Elgin, Ill.	.....	.80	1.00	.80	.80	.80
Elkhart Lake, Wis.	.70	.58	.90	.90	.72	.72
Ft. Dodge, Ia.	.....	1.22	.....	2.17	.....	.....
Grand Rapids, Mich.	.....	.50	.....	.85	.....	.75
Greenville, Mechanicsburg, O.	.60	.50	.50	.50	.60	.60
Hawarden, Ia.	.....	.50	.....	.....	1.60	.....
Hersey, Mich.	.50	.50	.....	.....	.70	.70
Indianapolis, Ind.	.60	.60	.....	1.50	.75@1.00	.75@1.00
Janesville, Wis.	.....	.65@ .75	.....	.....	.65@ .75	.....
Le Mars, and Doon, Ia.	.....	.90	.....	1.80	.....	.....
Libertyville, Ill.	.....	.70	.....	.70	.70	.....
Mankato, Minn.	.50	.50	.75@1.50	.75@1.50	.75@1.50	.75@1.50
Mason City, Ia.	.....	.55	1.80	1.55	1.55	1.55
Milwaukee, Wis.	1.15	1.15	1.25	1.25	1.25	1.25
Minneapolis, Minn.	.50	.50	1.50	1.35	1.25	1.25
Moline, Ill.	.60@1.00	.60@1.00	1.60	1.60	1.60	1.60
Riton, Wis.	.....	.40	.....	.....	.50	.50
St. Louis, Mo., f. o. b. cars....	1.20	1.52½	1.67½	1.47½	1.42½	1.42½
St. Louis, Mo., delivered on job ..	2.05	2.20	2.35	2.15	.....	2.10
Summit Grove, Clinton, Ind.....	.75	.75	.75	.75	.75	.75
Terre Haute, Ind.	.75	.75	.....	.85	.75	.85
Waukesha, Wis.	.60	All other sizes, .70 per ton				
Winona, Minn.	.60	.50	1.75	1.50	1.25	1.25
SOUTHERN:						
Alexandria, La.	.60@ .80	.50@ .75	.....	.....	.85@1.50	1.20@1.50
Birmingham, Ala.	1.48	all gravel—1.88				
Charleston, W. Va.	.....	(Sand, 1.40@1.50; gravel, 1.50				
Estelle Springs, Tenn.	1.15	1.10	.....	.....	1.00	.85
Ft. Worth, Tex.	.....	2.00	.....	2.00	.....	2.00
Jackson's Lake, Ala.	.50@ .60	.50@ .60	.40@1.00	1.00	.50@1.00	.50@1.00
Knoxville, Tenn.	1.00@1.15	1.00@1.15	.....	2.12	1.92	1.74
Lake Weir, Fla.	.....	.75	.....	.....	.....	.....
Macon, Ga.	.....	.50@ .75	.....	.....	.....	.....
Memphis, Tenn.	1.12	1.12	.....	.....	.....	1.95
N. Martinsville, W. Va.	.....	1.10	.....	1.30	.....	.90
New Orleans, La.	.....	.50	.....	.....	1.00	.....
Pine Bluff, Ark.	.90@1.25	1.00@1.20	Washed gravel, all sizes, 1.75			
Roseland, La.	.25	.....	.85	.....	.....	.....
WESTERN:						
Grand Rapids, Wyo.	.50	.50	.85	.85	.80	.80
Kansas City, Mo.	(Kaw River sand, car lots, .75 per ton, Missouri River, .85)					
Los Angeles, Calif.	.....	.90	1.50	1.50	1.25	1.25
Niles, Calif.	1.00	1.00	1.40	1.00	1.00	1.00
Pueblo, Colo.	1.10•	1.00•	.....	.....	1.50•	.....
San Diego, Calif.	.80@1.00	.80@1.00	1.30@1.60	1.25@1.55	1.15@1.45	1.10@1.40
San Francisco, Calif.	.....	1.00	1.00@1.20	.85@1.00	.85@1.00	.85@1.00
Seattle, Wash.	1.50•	1.50•	2.00•	1.50•	.....	1.50•
Yutan, Neb.	.40	Bank run .40				

Bank Run Sand and Gravel

City or shipping point	Fine Sand, 1/10 inch down	Sand, ¼ inch and less	Gravel, ½ inch and less	Gravel, 1 inch and less	Gravel, 1½ inch and less	Gravel, 2 inch and less
Attica, Covington, Silverwood, Ind., and Palestine, Ill.	.75	.75	.75	.75	.75	.75
Boonville, N. Y.	.60@ .80	.....	.55@ .75	.....	.....	1.00
Cape Girardeau, Mo.	River sand, 1.00 per yd.					
Cherokee, Ia.	.80 per ton—1.20 washed					
Detroit, Mich.	1.10•	.....	.....	.....	.....	.....
Dudley, Ky. (Crushed Sand)..	.....	1.05	.....	1.00	.....	.....
East Hartford, Conn.	.65 per cu. yd.					
Elkhart Lake, Wis.	Washed gravel .66					
Estelle Springs, Tenn.	.....	.....	.....	.....	.....	.85
Fishers, N. Y.	.60@ .65	.....	.....	.60	.....	.50
Glenville, N. Y.	.....	.....	.....	1.00•	.....	.....
Hamilton, O.	.45 per cu. yd. in pit					
Hartford, Conn.	.....	1.00•	.....	.....	.....	.....
Hersey, Mich.	.....	.....	.....	.50	.50	.....
Indianapolis, Ind.	Mixed gravel for concrete work, .65					
Janesville, Wis.	.....	.65	.....	.....	.65@ .75	.....
Lindsay, Tex.	.....	1.45	.....	.....	.....	.55
Oxford, Mich.	.....	.....	.....	.65	.65	.....
Pine Bluff, Ark.	Road gravel .60					
Rochester, N. Y.	.60@ .75	.60@ .75	.....	.....	.50@ .65	.50@ .65
Roseland, La.	.....	.75	.....	.....	.....	.....
Saginaw, Mich., f. o. b. cars....	.....	.75	1.30	1.30	1.30	1.30
St. Louis, Mo.	60% gravel, 40% sand, 1.57½					
Summit Grove, Ind.	.60	.60	.60	.60	.60	.60
Waco, Texas	.....	.80	.....	1.50	.....	1.30
Winona, Minn.	.....	.....	.70	.70	.70	.70
Yardville, N. J.	.....	.50@ .75	.....	.....	.....	.....
York, Pa.	.....	1.10@1.20	(crushed rock sand)			

•Cubic yard. B Bank. L Lake. || Ballast.

Crushed Slag

City or shipping point	Roofing	¼ inch down	½ inch and less	¾ inch and less	1½ inch and less	2½ inch and less	3 inch and larger
EASTERN:							
Buffalo, N. Y.	2.25	1.25	1.25	1.25	1.25	1.25	1.25
E. Canaan, Conn.	4.00	1.10	2.50	1.35	1.35	1.25	1.25
Eastern Pennsylvania and Northern New Jersey	2.50	1.20	1.50	1.20	1.20	1.20	1.20
Easton, Pa.	2.00	.90	1.50	1.00	1.00	1.00	1.00
Erie, Pa.	2.25	1.25	1.25	1.25	1.25	1.25	1.25
Emporium, Pa.	2.25	1.25	1.25	1.25	1.25	1.25	1.25
Lebanon, Pa.	2.50	.85	1.50	.85	.85	.85	.85
Sharpsville and West Middlesex, Pa.	2.00	1.30	1.70	1.30	1.30	1.30	1.30
Western Pennsylvania	2.50	1.25	1.50	1.25	1.25	1.25	1.25
CENTRAL:							
Chicago, Ill.	All sizes, $1.50, F. O. B. Chicago						
Detroit, Mich.	All sizes, 1.65, F. O. B. Detroit						
Ironton, O.	2.05	1.75	Other grades 1.55½				
Steubenville, O.	2.00	1.40	1.70	1.40	1.40	1.40	1.40
Toledo, O.	2.93	2.30	2.49	2.49	2.49	2.30	2.30
Youngstown, Dover, Hubbard, Leetonia, Struthers, O.	2.00	1.25	1.50	1.25	1.25	1.25	1.25
Steubenville, Lowellville and Canton, O.	2.00	1.35	1.60	1.35	1.35	1.35	1.35
SOUTHERN:							
Alabama City, Ala.	2.05	.80	1.00@1.25	1.15	1.05@1.10	.85@1.00	.85@ .90
Birmingham, Ala.	2.05	.80	1.25	1.15	1.10	.95	.85
Ensley, Ala.	2.05	.80	1.25	1.15	1.10	.95	.85
Longdale, Goshen, Glen Wilton & Low Moor, Va.	2.50	1.00	1.60	1.25	1.25	1.15	1.05

Lime Products (Carload Prices Per Ton F.O.B. Shipping Point)

	Finishing Hydrate	Masons' Hydrate	Agricultural Hydrate	Chemical Hydrate	Ground Burnt Lime Blk.	Ground Burnt Lime Bags	Lump Lime Blk.	Lump Lime Bbl.
EASTERN:								
Adams, Mass.			7.00					3.50
Bellefonte, Pa.			11.50		8.00			
Berkley, R. I.			14.00					2.50
Buffalo, N. Y.		11.00	11.00	11.00			9.50	2.00•
Chaumont, N. Y.					2.50	4.00		
Lime Ridge, Pa.							5.50	
Paxtang and Le Moyne, Pa.					5.00		5.00@7.50	
Rockland, Maine						8.00		
Union Bridge, Md.			13.00		5.50			
West Rutland, Vt.	13.50	12.25	7.50@12.25	14.00			11.00	3.50
West Stockbridge, Mass.			15.00					
Williams and Blue Bell, Pa.			11.25					
Williamsport, Pa.			10.00			10.00	6.00	
York, Pa. (dealers' prices)		9.50	9.50	9.50 (mfrs.)			7.50	
CENTRAL:								
Delaware, Ohio	10.50	8.50	7.50	10.00	7.50		7.50	1.60
Geneo, Ohio	10.50§							
Gibsonburg, Ohio	10.50§	8.50	8.50		6.75	8.75		
Huntington, Ind.	10.50	9.00	8.50				8.00	1.70•
Knowles and Valders, Wis.			12.50		5.00	9.00		
Marblehead, Ohio	10.50	8.50		11.00	6.75		8.00	1.70•
Mitchell, Ind.		11.00	11.00	11.00	9.50		8.50	1.45
Sheboygan, Wis.					5.50	8.50		
White Rock, Ohio	10.50				6.75	8.75		
Woodville, O. (dlrs.' price)	10.50a	8.00a	8.00a	8.50a	7.50	8.00	8.00	1.70
SOUTHERN:								
El Paso, Tex.							12.50	
Knoxville, Tenn.	11.00	9.50	9.50				7.50	1.30
Ocala and Zuber, Fla.	13.00	12.50	11.00	12.50	1.50	7.00		
Sherwood, Tenn.	11.00	9.50	9.50	9.50	2.50		7.50	1.30
Staunton, Va.					8.00		9.50b	1.60
WESTERN:								
Colton, Calif.			15.00				19.70	
Kirtland, N. Mex.					12.00		12.50	2.00c
Los Angeles, Calif.			15.00‡				16.00	
San Francisco, Calif.	22.00		15.00@16.00	25.00			16.00	2.15•
Tehachapi, Calif.						15.00	13.00	2.00

‡100-lb. sacks; *180-lb. net, price per barrel; †180-lb. net, non-returnable metal barrel; §Paper sacks. (a) 50-lb. paper bags; terms, 30 days net; 25c per ton or 5c per bbl. discount for cash in 10 days from date of invoice. (b) Burlap bags. (c) 200-lb. bbl.

Miscellaneous Sands

(Continued from preceding page)

Conneaut, O.—Molding fine	2.25@2.50
Molding coarse	2.00@2.25
Delaware, N. J.—Molding fine	2.00
Molding coarse	1.90
Brass Molding	2.15
Dresden, O.—Molding coarse	1.50@1.75
Brass molding	1.75
Dunbar, Pa.—Traction, damp	2.35
Dundee, O.—Glass, core, sand blast, traction	2.50
Molding fine, brass molding (plus 75c for winter loading)	2.00
Molding coarse (plus 75c for winter loading)	1.75
Falls Creek, Pa.—Glass sand	2.50
Furnace lining, traction and molding coarse and fine, and core	2.00
Sand blast	3.50
Eau Claire, Wis.—Core	.75@1.25
Sand blast	3.25@4.25
Traction sand	.50
Franklin, Pa., and Utica, Pa.—Traction	2.00
Brass molding	2.75
Core	1.25@2.00
Molding fine	2.75
Molding coarse	2.50
Furnace lining	2.50
Greenville, Ill.—Molding coarse	1.40@1.60
Howard, Ohio — Core, furnace lining, molding fine, stone sawing, traction, brass molding	2.00
Sand blast	4.00
Roofing sand	2.50
Glass sand	2.50@3.00
Joliet, Ill.—Milled, dried and screened No. 2 coarse molding sand and open hearth loam and looting clay	.90@1.25
Kansas City, Mo.—Missouri River core	.80
Kasota, Minn. — Molding coarse and fine, stone sawing (pit run)	1.75
Klondike, Pacific and Gray Summit, Mo.—Molding fine and core	1.75@2.25
Mapleton, Pa.—Core, furnace lining, molding coarse and brass molding	2.00@2.75
Molding fine	2.25@2.75
Roofing sand	2.00@3.00
Sand blast	1.50@2.00
Glass sand	2.25@2.50
Massillon, O.—Traction, molding fine and coarse, core, and furnace lining	2.50
Glass sand	3.00
Michigan City, Ind.—Core, traction	.30@ .40
Mineral Ridge, Ohio — Core, furnace lining, molding fine and coarse, roofing, sand blast, stone sawing and traction (green)	2.00
Montoursville, Pa.—Core	1.25@1.40
Traction	1.00@1.25
Brass molding	1.50
New Lexington, O.—Molding fine	2.75
Molding coarse	2.50
Oregon, Ill.—Core, glass sand	1.25@1.75
Furnace lining	1.50@1.75
Molding coarse	1.25@1.75
Sand blast and stone sawing	3.00@3.50

Miscellaneous Sands

(Continued)

Ottawa, Ill. — Furnace lining, steel molding, core, roofing sand	1.50
Sand blast	3.50
Ottawa, Minn.—Core	1.00@1.50
Glass, molding coarse, stone sawing (all crude silica)	1.00@1.50
Pelzer, S. C.—Glass sand (carload lots only)	.70
Rockwood, Mich.—Core, damp	2.50
Roofing	2.75
Sand blast	3.00
Round Top, Md.—Glass sand	1.75@2.00
Core, furnace lining	1.45
Traction	1.60
(All per 2000 lbs.)	
San Francisco, Cal.—Glass and roofing	3.00@3.50
Core, molding fine and brass	2.30@2.60
Furnace lining and molding coarse	3.60@4.25
Coarse core sand	3.60@4.25
Sand blast	2.30@3.60
Stone sawing and traction	2.30
Thayer, Pa.—Traction	2.00
Furnace lining, m'ld'g fine and coarse	1.25
Core—green	1.75@2.00
Utica, Ill.—Core	.85@1.10
Glass sand	1.25@1.50
Furnace lining	.85@2.00
Molding fine and coarse	.85@1.25
Roofing sand	1.25
Sand blast	2.25@3.00
Stone sawing	1.25@2.25
Traction and brass molding	1.25
Utica, Pa.—Core	1.25@2.25
Molding fine and coarse, traction, brass molding	2.00
Warwick, O. — Core, furnace lining, molding fine and coarse (damp, 1.75) dry	2.00
Traction, brass molding (dry)	2.00
Zanesville, O. — Core, furnace lining, molding fine, traction	2.00
Molding coarse	1.75
Sand blast	4.50
Brass molding	2.00@2.25

Talc

Prices given are per ton f. o. b. (in carload lots only) producing plant, or nearest shipping point.

Baltimore, Md.—Crude Talc	3.00
Cubes	50.00
Blanks, per lb.	.07
Chatsworth, Ga.—Crude talc	8.00@10.00
Ground talc (150-200 mesh), bags	12.50
Pencils and steel workers' crayons, per gross	1.50@ 2.00
Chester, Vt. — Ground talc (150-200 mesh)	8.00@10.00
(In Kraft paper bags. $1.00 per ton less in burlap bags, plus 15c for each bag.)	
Emeryville, N. Y.—150-200 mesh; bags	13.50
Glendale, Calif. — Ground talc (150-200-mesh	16.00@30.00
(Bags extra)	
Ground Talc (50-300 mesh)	13.50@15.50
Gordonsburg, Tenn.—B.P.L. 68%@72% 200 mesh)	4.50@6.00 13.50@14.50
Henry, Va.—Crude talc (lump mine run), per 2000-lb. ton	2.75@3.50
Ground talc (20-50 mesh), bags, 7.00; (200-300 mesh) bags	8.25@11.00
Johnson, Vt.—Ground talc (20-50 mesh), bulk	8.00
(Bags extra)	
Ground talc (150-200 mesh), bulk	10.00@15.00
(Bags extra)	
Los Angeles, Calif—Ground talc (150-200 mesh)	18.00@40.00
Natural Bridge, N. Y.—Ground talc (150-200 mesh) bags	12.00@13.00
Rochester and East Granville, Vt.—Ground talc (20-50 mesh), bulk	8.50@10.00
(Bags extra)	
Ground talc (150-200 mesh), bulk	10.00@22.00
(Bags extra)	
Vermont—Ground talc (20-50 mesh); bags	8.00@10.00
Ground talc (150-200 mesh); bags	9.00@16.00
Waterbury, Vt.—Ground talc (20-50 mesh), bulk	8.50
(Bags $1.00 extra)	
Ground talc (150-200 mesh), bulk	10.00@15.00
(Bags 1.00 extra)	
Pencils and steel workers' crayons, per gross	1.20@ 2.00

Rock Phosphate

Raw Rock

Per 2240-lb. Ton

Centerville, Tenn—B.P.L. 72% to 75%	6.00@8.50
B.P.L. 65%	6.00
Gordonsburg, Tenn.—B.P.L. 68%@72%	4.50@6.00
Mt. Pleasant, Tenn—Analysis, B.P.L. (2000 lbs.)	.70 7.50
Montpelier, Idaho—70% B.P.L.—Crude	5.00
Crushed 2-in. ring and dried	6.00

(Continued on next page)

Roofing Slate

The following prices are per square (100 sq. ft.) for Pennsylvania Blue-Gray Roofing Slate, f.o.b. cars quarries:

Sizes	Genuine Bangor, Washington Big Bed, Franklin Big Bed	Genuine Albion	Slatington Small Bed	Genuine Bangor Ribbon
24x12	$ 9.30	$8.40	$8.10	$7.80
24x14	9.30	8.40	8.10	7.80
22x12	10.80	8.70	8.40	9.10
22x11	10.80	8.70	8.40	9.10
20x12	10.80	8.70	8.40	9.10
20x10	11.70	9.00	8.70	8.40
18x10	11.70	9.00	8.70	8.40
18x 9	11.70	9.00	8.70	8.40
16x10	11.70	8.40	8.40	8.10
16x 9	11.70	8.40	8.40	8.10
16x 8	11.70	8.40	8.40	8.10
18x12	11.10	8.70	8.40	8.10
16x12	11.10	8.70	8.40	8.10
14x10	11.10	8.40	8.10	7.80
14x 8	11.10	8.40	8.10	7.80
14x7 to 12x6	9.60	8.40	8.10	.....
	Mediums	Mediums	Mediums	Mediums
24x12	$ 8.10	$7.50	$7.20	$5.75
22x11	8.40	7.80	7.50	5.75
Other sizes	8.70	8.10	7.80	5.75

For less than carload lots of 20 squares or under, 10% additional charge will be made.
Granulated slate per net ton f. o. b. quarries, Vermont and New York, 7.50

(Continued from preceding page)

Ground Rock

Paris, Idaho.—2,000 lb. mine run, B.P.L. 70%	4.00
Wales, Tenn.—B.P.L. 70%	7.50
Per 2000-lb. Ton	
Barton, Fla. — Analysis, 50% to 65% B.P.L.	3.50@5.00
Centerville, Tenn. — B.P.L. 60% to 65%	6.00@6.50
B.P.L. 75% (brown rock)	12.00
Columbia, Tenn.—B.P.L. 68% to 72%	5.50
B.P.L. 65% (90% thru 200 mesh) bulk	5.50
Morreston, Fla.—Analysis 60% B.P.L.	12.00
Mt. Pleasant, Tenn.—B.P.L. 65@70%	5.00@6.50
Norwills, Fla.—(Fla. Hard Rock)—B.P.L. 68%	10.00

Florida Soft Phosphate

Raw Land Pebble

Per Ton

Bartow and Norwills, Fla.—B.P.L. 50%, bulk	6.00@ 8.00
B.P.L. 78%, bulk	13.50
Jacksonville (Fla.) District	10.00@12.00

Ground Land Pebble

Per Ton

Jacksonville (Fla.) District	14.00
Add 2.50 for sacks.	
Lakeland, Fla.—B.P.L. 60%	6.00
Morristown, Fla.—26% phos. acid	16.00
Mt. Pleasant, Tenn.—65-70% B.P.L.	6.00@ 7.00

Special Aggregates

Prices are per ton f. o. b. quarry or nearest shipping point.

City or shipping point	Terrazzo	Stucco chips
Chicago, Ill.—Stucco chips, in sacks f.o.b quarries		17.50
Deerfield, Md. — Green; bulk	7.00	7.00
Easton, Pa.—Evergreen, creme green and royal green marble	18.00@20.00	10.00@14.00
Granville, N. Y. — Red slate granules		7.50
Ingomar, Ohio	12.00@22.00	35.00
Lincoln, Neb. — Red, white, grey, in bags		30.00
Middlebrook, Mo.—Red granite; sacks	30.00@32.50	20.00@25.00
Milwaukee, Wis.	21.00@30.00	21.00@27.50
Missouri river points — Different colors	20.00@25.00	20.00@25.00
Piqua, O.—Marble	8.00@10.00	7.00@ 9.00
Poultney, Vt. — Roofing granules		7.50
Sioux Falls, S. D.	7.50	7.50
Tuckahoe, N. Y.—White marble	7.00@12.00	12.00
Crushed white stone and marble dust in 100 lb. bags	6.50@12.00	.....
Tate, Ga.—White limestone, sacks extra	5.00@ 7.00	5.00@ 7.00
Wausau, Wis.	14.00@18.00	.....

Concrete Brick

Prices given per 1,000 brick, f. o. b. plant or nearest shipping point.

	Common	Face
Appleton, Minn.	18.00	26.00@34.00
Bellow Falls, Vt.	18.00	25.00
Birmingham, Ala.	16.00	27.50@50.00
Bridgeport, Conn.	31.00	32.00
Carpenterville, N. J.	15.50	40.00@65.00
Easton, Pa.	16.00	40.00@60.00
Eau Claire, Wis.	.....	30.00@50.00
Eugene, Ore.	25.00@27.00	35.00@75.00
Rochester, N. Y.	21.00	.....
Friesland, Wis.	25.00	.....
Houston, Tex.	.....	19.50
Lockport, N. Y.	17.00	.....
Omaha, Nebr.	16.00@20.00	30.00@40.00
Piqua, O.	15.00	25.00@50.00
Phoenix, Ariz.	16.00	35.00@80.00
Portland, Ore.	23.75	45.00@75.00
Puyallup, Wash.	22.00	50.00@75.00
Rapid City, S. D.	20.00	30.00@60.00
St. Paul, Minn.	15.00	30.00@35.00
Salem, Ore.	25.00@30.00	50.00@75.00
Salt Lake City, Utah	20.00	35.00@55.00
Seattle, Wash.	(select) 20.00	50.00@90.00
Springfield, Ill.	18.00	20.00@25.00
Tampa, Fla.	15.00	25.00@65.00
Walkersville, Ont.	30.00	36.00
Wauwatosa, Wis.	13.00@14.50	26.00@45.00
Winnipeg, Man., Can.	19.00	40.00

Sand-Lime Brick

Prices given per 1,000 brick f. o. b. plant or nearest shipping point, unless otherwise noted.

Albany, Ga.	7.00
Barton, Wis.	9.00
Boston, Mass.	11.50@12.50
Brighton, N. Y.	14.25
Buffalo, N. Y.	16.50
El Paso, Texas	12.00
Gary, Ind.	11.50@12.00
Grand Rapids, Mich.	12.00
Lancaster, N. Y.	12.50
Michigan City, Ind.	10.00
Milwaukee, Wis. (delivered at job)	13.00
Minneapolis, Minn.	13.00
Plant City, Fla.	10.00
Portage, Wis.	15.00@25.00
Redfield, Mass.	15.00
Saginaw, Mich.	11.50
San Antonio, Texas—Common	15.00
South Dayton, Ohio	12.50@13.50
Syracuse, N. Y. (delivered at job)	16.00@18.00
F. o. b. cars	14.00
Washington, D. C.	13.50
Winnipeg, Can.	14.00

Lime

Warehouse prices, carload lots at principal cities.

	Hydrate per Ton Finishing	Common
Atlanta, Ga.	19.00	16.00
Baltimore, Md.	15.00	13.00
Boston, Mass.	23.00	20.00
Cincinnati, Ohio	19.60	14.50
Chicago, Ill.	18.00	.....
Dallas, Tex.	25.00	.....
Denver, Colo.	30.00	.....
Detroit, Mich.	15.25	13.25
Fort Dodge, Ia.	19.70	17.00
Genoa, Ohio	10.50	.....
Grand Rapids, Mich.	15.65	.....
Gypsum, Ohio	13.90	.....
Los Angeles, Calif.	30.00	30.00
Minneapolis, Minn.	29.00	22.00
Montreal, Que.	21.00	21.00
New Orleans, La.	.....	17.25
New York, N. Y.	16.99	.....
Plasterco, Va.	19.80	.....
St. Louis, Mo.	23.20	20.00
San Francisco, Calif.	22.00	18.00
Seattle, Wash.	27.00	.....

	Lump per 180-lb. Barrel (net) Finishing	Common
Atlanta, Ga.	2.00	1.50
Baltimore, Md.	.....	12.00†
Boston, Mass.	3.35	3.10
Cincinnati, Ohio	.....	12.25
Chicago, Ill.	.....	1.40
Dallas, Tex.	.....	2.75
Denver, Colo.	.....	2.95
Detroit, Mich.	11.50†	10.50†
Los Angeles, Calif.	3.00*	3.00*
Minneapolis, Minn.	1.70	1.40
Montreal, Que.	15.00†	.....
New Orleans, La.	.....	1.75
New York, N. Y.	.....	3.69*
St. Louis, Mo.	.....	.70*
San Francisco, Calif.	.....	1.90
Seattle, Wash.	3.25	2.75

*280-bbl. (net). †Per ton.

Portland Cement

Current prices per barrel in carload lots, f. o. b. cars, without bags.

Atlanta, Ga. (bags)	3.45
Boston, Mass.	2.61
Cedar Rapids, Ia.	2.26
Cincinnati, Ohio	2.35
Cleveland, Ohio	2.26
Chicago, Ill.	1.97
Dallas, Tex.	2.80
Davenport, Ia.	2.21
Denver, Colo.	2.69
Detroit, Mich.	2.17
Duluth, Minn.	1.95
Indianapolis, Ind. (cloth sacks) per bbl.	2.51
Kansas City, Mo.	2.30
Los Angeles, Calif.	3.06@3.20
Milwaukee, Wis.	2.18
Minneapolis, Minn.	2.24
Montreal, Can. (sacks 20c extra)	2.40
New Orleans, La.	2.88
New York, N. Y. (includes bags)	2.35
(10c per bbl. discount in 10 days)	
Pittsburgh, Pa.	2.02
Portland, Ore. (sacks 10c ea.)	3.05
St. Louis, Mo. (incl. sacks)	2.20
San Francisco, Calif. (sacks 10c ea.)	2.73
St. Paul, Minn.	2.24
Toledo, Ohio	2.20
Seattle, Wash. (incl. sacks, 10c ea.)	3.34
F. o. b. Seattle (including sacks)	3.50

NOTE—Add 40c per bbl. for bags.

Gypsum Products—CARLOAD PRICES PER TON AND PER M SQUARE FEET, F. O. B. MILL

	Crushed Rock	Ground Gypsum	Agricultural Gypsum	Stucco* Calcined Gypsum	Cement‡ and Gauging Plaster	Wood Fiber	White‖ Gauging	Sanded Plaster	Keene's Cement	Trowel Finish	—Plaster Board— ⅜x32x36" Weight 1500 lbs. Per M Sq. Ft.	⅜x32x36" Weight 1850 lbs. Per M Sq. Ft.	Wallboard, ⅜x32 or 48", Lengths 6'-10', 1850 lbs. Per M Sq. Ft.
Alabaster, Mich.	3.00	4.00	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Blue Rapids, Kan.	3.00	4.00	6.00	8.00	10.00	10.50	10.00	.....	23.75	19.00	19.375	20.00	36.75
Douglas, Ariz.	.....	.....	5.00	13.00	.....	10.50@13.00	.....	.....	.....	13.00	.....	.....	.....
Eldorado, Okla.	.....	.....	.....	.....	10.00	10.50	10.00	.....	15.50	.....	27.20	29.30	39.55
Fort Dodge, Ia.	3.00	4.00	6.00	8.00@11.00	10.00	10.50	15.45@22.00	.....	25.80	20.00	19.375	20.00	30.00
Garbutt, N. Y.	.....	.....	6.00	8.00	10.00	10.00	.....	7.00	.....	.....	.....	20.00	.....
Grand Rapids, Mich.	3.00	4.00	6.00	8.00	10.00	10.00	18.50	.....	27.25	20.00	19.375	20.00	30.00
Gypsum, Ohio	3.00	4.00	6.00	8.00	10.00	10.00	19.25	7.50	27.95	19.00	19.375	20.00	30.00
Loveland, Colo.	3.00	4.00	6.00	8.00	10.00	10.50	.....	.....	29.80	.....	.....	.....	40.00
Oakfield, N. Y.	3.00	4.00	6.00	8.00	10.00	10.00	20.20	7.00+	28.25	21.00	19.375	20.00	30.00
Piedmont, S. D.	.....	.....	6.00	8.00	10.00	10.50	.....	.....	32.25	.....	27.97	31.04	41.18
Plasterco, Va.	4.00	.....	7.00	8.00	10.00	10.00	20.90	.....	29.90	19.00	21.375	22.00	.....
Southard, Okla.	3.00	4.00	6.00	8.00	10.00	10.50	10.00	.....	15.50	.....	26.20	28.70	30.00
Winnipeg, Man.	5.50	5.50	7.00	16.00	16.00	.....	.....	.....	32.50	18.00	28.50	30.00	35.00

NOTE—Returnable Jute Bags, 15c each, $3.00 per ton; Paper Bags, $1.00 per ton extra.
*Shipment in bulk 25c per ton less; ‡Bond Plaster $1.50 per ton additional; +Sanded Wood Fiber $2.50 per ton additional; ‖White Moulding 50c per ton additional; ||Bulk; (a) Includes sacks.

News of All the Industry

Sand and Gravel

The Midland Sand and Gravel Co., Dallas, Texas, has been incorporated at $200,000 by E. S. Heyser, W. E. Callahan and William McCormick.

Muskogee Sand and Gravel Co., Muskogee, Okla., has been incorporated at $50,000 by R. T. Price, Milton Young. A. L. Beeman is superintendent. The company has leased 40 acres of gravel beds for development.

The Doe River Sand Co., Johnson City, Tenn., is planning for the installation of machinery at its properties on the Doe River, including washing and screening equipment, elevator and hoist, power equipment, cars, etc. The company was incorporated recently. R. N. Campbell is president.

The Oquawka Sand and Gravel Co., Oquawka, Ill., has recently been organized by John Markman of Gladstone. Operations will be under way before next spring. The plant is expected to have a capacity of 20 carloads a day. The company has a material bed of sand located in the Mississippi river, and is said to be the only bed located between Muscatine and St. Louis. Switch tracks to the plant will be put in, making it possible for the company to load its sand and gravel direct to the cars.

Quarries

The Oliver I. Lines Co., Butte, Mont., has been incorporated at $20,000, to operate a marble and tile business, by Oliver I. Lines, Caroline Lines and Joseph H. Griffin, all of Butte, Mont.

Alexander Granite & Sand Co., Statesville, N. C., J. M. Deaton, president, plans to develop a rock quarry. A four-mile railroad will be built from Hiddenite to Rocky Face Mountain. J. B. Roach is the engineer.

Barre, Vt.—A certificate of action by the stockholders of the Marr & Gordon, Inc., granite manufacturers, Barre, Vt., increasing the capital stock from $50,000 to $250,000, was filed at Montpelier, Vt., on January 13. William D. Reid is president.

The Spring Creek Limestone Co., Lebanon, Pa., recently held its annual election of directors and of officers. They are: Albert Herr, Denver Herr and L. Raymond Riegert, as directors; president, L. Raymond Riegert; secretary and treasurer, Albert Herr.

Cement

The Patton Cement Plaster Co., Rotan, Texas, expects to begin operations early in March. J. W. Patten is president of the company.

The Peerless Portland Cement Co., Union City, Mich., is installing two 42 in. Fuller mills in the coal house for preparing all the pulverized coal used as fuel in this plant.

The Continental Portland Cement Co., Continental, Mo., is installing a modern coal pulverizing and conveying system for fuel. This system includes three 46 in. Fuller-Lehigh pulverized mills and one Fuller-Kinyon conveying system for conveying the coal from the mills to the various furnace bins.

Bay City, Mich.—A site has been purchased near Bay City, Mich., and plans are being formulated in the eastern office of the Aetna Portland Cement Co. for a new cement plant to cost approximately $1,000,000. Oscar J. Lingemann, general manager, states that definite plans have not been decided upon, and the time for starting construction is still indefinite. The new site is on the Saginaw River at Essexville. Dredging to establish water shipping facilities will probably be included in the preliminary work.

Denver, Colo.—At the annual meeting of the Cement Securities Co. held on January 12, the following directors were elected: Charles Boettcher, Claude K. Boettcher, Harry C. James, James Q. Newton, John H. Porter, M. D. Thatcher and R. J. Morse. The new board organized by electing the following officers: President, Charles Boettcher; vice-presidents, Claude K. Boettcher, Harry C. James and R. J. Morse; treasurer, Harry C. James; secretary, R. J. Morse; assistant secretary, Carrie H. Morse.

The Bath Portland Cement Co., Bath, Pa., is remodeling its coal plant by installing three modern 42 in. Fuller mills for pulverizing coal. A Fuller-Kinyon conveying system is being installed in connection with these mills, which will convey the pulverized coal from the mills to the kiln bins. The conveying line will eventually be extended to the stone dryers, which will be fired with pulverized coal. The waste heat boiler plant, recently put in service, will also use pulverized coal as an auxiliary fuel, the supply of pulverized coal being furnished from the coal house by means of a Fuller-Kinyon pump.

Sinaloa, Mexico—Consul W. E. Chapman at Mazatlan advises that the Mexican government contemplates the purchase of several thousand tons of cement for use in connection with the construction of an irrigation canal in the vicinity of Culiacan, the capital of the state of Sinaloa, on which project the excavation is now nearing completion. The canal is about 70 miles long. It appears that it has not been definitely determined as to what portion of it will be concreted and that a decision will depend upon experiments in concrete work that are now about to be done on one or two sections of the canal. Interested parties in the United States should address their communications to Gen. Angel Flores, Mazatlan, Sinaloa, Mexico.

Gypsum

The Structural Gypsum Corp., Jersey City, N. J., has been incorporated with a capital of $1,125,000 to manufacture gypsum products. The company is represented by the Registrar & Transfer Co., 15 Exchange place, Jersey City.

Manufacturers

The Chicago Mining Sheave & Roller Co., manufacturers of mining sheaves and rollers, 2320 West Chicago avenue, Chicago, has recently published a folder describing the special features of Chicago rollers, together with prices and specifications.

The Ogdensburg Limestone Products Co., 111 Broadway, New York City, is manufacturing limestone for chemical and agricultural purposes, and for asphalt filler, etc. This product will pass a sieve test of 75 per cent through a 200-mesh sieve; it contains 98 per cent of combined carbonates.

The American Manganese Steel Co., Chicago Heights, Ill., a new department in its organization, forged and rolled manganese steel. This department has been made possible by the remarkable advancement in the perfection of rolling and forging this peculiar metal, so widely known for its non-breakable qualities combined with long wear.

The Blue Diamond Materials Co., Boston, Mass., has been organized to distribute in Eastern territory ready-mixed mortar, wet plaster and lime putty under the Hay process. The plant is now under construction and if weather conditions permit will be ready for production on or about March 1. The plant will be located at the pit of the Highland Sand and Gravel Co. in the West Roxbury section of Boston, where it has access to one of the best sand deposits in this territory.

Barber-Greene Co., Aurora, Ill., has given D. B. Frisbie, Atlanta, Ga., the development of a selling organization throughout the South for its products, B-G portable belt conveyors and B-G self-feeding bucket loaders. These sales companies are under Mr. Frisbie's direction: General Utilities Co., Norfolk, Va.; Standard Equipment & Machinery Co., Spartanburg, S. C.; A. B. Moore, Jr., Savannah, Ga.; Alabama Machinery & Supply Co., Montgomery; J. D. Turner Co., Birmingham, Ala.; Wilson, Weesner & Co., and Dealers' Coal Mining Co., Nashville, Tenn.; E. W. Price, Tampa, Fla.; Higgins & Warmington and A. M. Lockett Co., New Orleans.

Pawling & Harnischfeger Co., Milwaukee, distributed a novel piece of printed matter at the Chicago Good Roads Show, consisting of two discs with an eyelet in the center. The idea was to show why the P. & H. excavator crane was an "8 in 1" machine. By moving the upper disc in a circle the various booms that may be used with the P. & H. appear successively—the standard boom with dragline bucket, boom with grab bucket, boom with material handling hook, boom with magnet, boom with backfilling scraper, shovel attachment, skimmer scoop and pile driving rig. In fact, this novelty tells the story without words.

Personal

Albert Y. Gowen, vice-president of the Lehigh Portland Cement Co., Chicago, and Mrs. Gowen have arrived at Sydney, N. S. W., on their 98-ft. motor yacht, the Speejacks, after an adventurous cruise across the Pacific ocean, having sailed from New York on August 21, 1921, via Panama. The party stopped at Tahiti, Pago-pago, Suva and Noumea. Capt. Jack Lewis said the vessel behaved splendidly with the exception of the steering gear, which broke down near Tahiti. Once the water reserves ran so low that cocoanut milk was substituted for drinking purposes. Mr. Gowen intends to continue the voyage via the Solomon Islands, the Philippines, China and Japan and thence to European waters. He will stop in England and then cross the Atlantic for home.

Harrison E. Howe has been elected to succeed Dr. Charles H. Herty as editor of the Journal of Industrial and Engineering Chemistry and director of the A. C. S. News Service, conducted by the American Chemical Society. Mr. Howe, who is a well known industrial chemist, was born in Georgetown, Ky. He was graduated from Earlham College, Richmond, Ind., with the degree of Bachelor of Science. He was a graduate student of the University of Michigan and became a Master of Science at the University of Rochester. As chief chemist of the Sanilac Sugar Refining Co., in like capacity with the Bausch & Lomb Optical Co., Rochester, N. Y., and as manager of the commercial department of A. D. Little, Inc., Boston, and manager of the Montreal offices of that organization he became familiar with the broadest phases of industrial chemistry. In the world war he was consulting chemist of the nitrate division of the Ordnance Bureau. Until his election to his present position Mr. Howe was at the head of the Division of Research Extension of the National Research Council. Dr. Herty resigned the editorship to accept the presidency of the newly formed Synthetic Organic Chemical Manufacturers' Association of the United States, which has opened offices at 1 Madison avenue.

Obituary

Dr. William Frear, vice-director of the Pennsylvania Agricultural Experiment Station, died recently. Dr. Frear was the oldest member of the faculty of the Pennsylvania State College in point of service. He was apparently in the best of health until the day before his death. Dr. Frear was a great advocate of agricultural lime and limestone.

James B. Lyne, 90 years old, retired stone quarry operator, died on January 12 at the home of his daughter, Mrs. Edwin R. Fletcher, Bloomington, Ind., with whom he had made his home for several years. Death was due to a general breakdown resulting from age. Mr. Lyne was president of the Terre Haute Stone Co., which operates quarries at Stinesville, and during his active career the company supplied stone to build many public buildings and churches throughout Indiana and Illinois.

Used Equipment

Rates for advertising in the Used Equipment Department: $2.50 per column inch per insertion. Minimum charge, $2.50. Please send check with your order. These ads must be paid for in advance of insertion.

RETURN TUBULAR LOCOMOTIVE **BOILERS** WATER TUBE SCOTCH MARINE

A LARGE STOCK OF HIGH-GRADE BOILERS OF PRACTICALLY ALL SIZES, TYPES AND MAKES, TAKEN OVER FROM DU PONT CHEMICAL COMPANY'S AND OTHER PLANTS WITH PRODUCTION RECORDS—RECONDITIONED, OFFERED SUBJECT TO ANY INSPECTION, AVAILABLE *NOW!*

"SAVE TIME AND MONEY ON YOUR POWER INSTALLATION—LET **DAVIS** FURNISH THE BOILERS"

LONG DISTANCE TELEPHONE RANDOLPH 2232

J. F. DAVIS

1122-1123-1124 Harris Trust Building CHICAGO, ILL.

60 x 84 TRAYLOR JAW

crusher, placed on foundations, but never put in service.

2—24"x37" type 15-B Farrell crushers.
2—24"x36" type 14-B Farrell crushers.
1—18"x24" Farrell jaw crusher.
1—16"x32" Acme jaw crusher.
1—12"x24" Reliance jaw crusher.
1—11"x20" Acme jaw crusher.
1—9"x16" Reliance jaw crusher.
1—7½"x13" Champion jaw crusher.

We can also offer other jaw crushers, gyratory crushers, elevators, screens, and general quarry equipment.

READING ENGINEERING CO., INC.
1227-A Tribune Bldg. New York, N. Y.

FOR SALE

1—40-Hp. F. B. Boiler with stack and fittings.
1—25-Hp. Portable Boiler and Engine mounted.
A quantity of good Stone Elevator Buckets. Size 17x12x7 and 13x10x7, in good serviceable condition.
1—Little Giant Steam Shovel, Track Type. Needs some minor repairs, but good for a lot of service.

Will Price These Right to Move Quickly.

Detroit-Oxford Gravel & Stone Co.
Oxford, Michigan

FOR SALE

1—Oshkosh Concrete Mixer	$ 300.00
4—Tripod Steam Rock Drills	75.00
1—Swing Hammer Pulverizer, with extra hammers	400.00
1—Sturtevant Rock Emery Mill	350.00
1—Gallon Car Unloader, 18-ton bin	350.00
1—Corrugated Crusher Head for No. 5K Crusher, almost new	75.00
1—Smooth Crusher Head for No. 6K Gates Crusher, brand new	175.00
1—Revolving Screen, 30" diam., 12' long	200.00
1—Dipper for Marion Model 60 Steam Shovel, 2 ½-yd., new	1000.00
1—Lot 2" Black Pipe, about 2500 ft.	
1—Worthington Duplex Steam Pump, 12" suction, 10" discharge, with brand new steam cylinders	600.00
1—Morris Centrifugal pump, direct connected to steam engine, 10" suc., 8" dis.	450.00
1—Worthington Duplex Pump, 4" suction, 3" discharge	100.00
1—Dean Bros. Duplex Boiler Feed Pump, 2" suction, 1⅛" discharge	75.00
100 ft. 30" 8-ply stitched canvas belt. Good as new	175.00

All of this equipment is in very good condition; some is almost new. If interested in any of the above items we would be pleased to hear from you.

BIG FOUR STONE CO., Ingalls, Ind.

FOR SALE

2—8x110 Rotary Kilns.
6—5x6x7x110' Rotary Kilns.
3—6x16' Tube Mills, Silax Lining.
9—5x21' Tube Mills, Steel Lining.
6—250 H.P. Oil City Water Tube Boilers.
2—No. 5 Gyratory Crushers.
8—Krupp Ball Mills.
1—No. 8 Austin Crusher.
4—Engines, 200 to 550 H.P.
Shafting, Pulleys, Bearings, and Elevator Equipment, all first class operating condition.

Engineering Sales Company
Nashville, Tenn.

W. L. Kaiser
Stockertown, Pa.

IMMEDIATE DELIVERY

SEND US YOUR INQUIRY, STEAM SHOVELS.
50—75-hp. Single Drum Hoists, 25 Cy. Motors.
25—40-55 hp. Double Drum Elec. Hoists, 60 cy.
Nos. 3, 5, 6, 7½, 9K, 18K CRUSHERS.
2—6- and 12-Ton Gasoline Locomotives.
10x12-in. Steam Hoist, 3 Drum with Boiler.
65-hp. Locomotive Type Boiler, 100 lbs.
150-hp. Boiler, Buttstrap with Stkr. 156 lbs.
No. 9K GATES CRUSHER, REGULAR DRIVE.
25, 50, 100, 200 Kw. and larger Turbo, Eng. Sets.
50 to 5000 ft. Steam, Belt & Elec. Drive Comp's.
10, 15 and 20 Ton Locomotive Cranes.
LARGE AMOUNT CONTRACTORS' EQUIP., LOCO. CRANES, TOWERS, ETC.

Send us your inquiries for Steam Eng's, Centrif. Pumps, Quarry Equip., Motors, Etc.

Ross Power Equip. Co., Indianapolis, Ind.

Idle Machinery Absorbs Profits

This department is the medium for the men who keep the wheels going. Sell your idle machinery to the man who'll keep it going.

Complete Quarry Equipment

to those contemplating new construction or additions to quarry equipment for the season of 1922.

As a result of alterations in plant equipment, and discontinuing of one operation, a large operator in the stone crushing field has for sale a complete line of high class used equipment, consisting of crushers, elevators, screens, compressors, steam shovels, locomotives and cars and other miscellaneous equipment.

This equipment is in A-1 condition, and should be sold direct to users. If in the market, address

Box 1522, Care of Rock Products
542 South Dearborn Street, Chicago, Ill.

New Rubber Belting

300 ft. 12" 6-ply	$0.99 per ft.
423 ft. 14" 5-ply	1.04 per ft.
527 ft. 14" 6-ply	1.25 per ft.
529 ft. 16" 6-ply	1.39 per ft.
520 ft. 16" 8-ply	1.90 per ft.
150 ft. 18" 6-ply	1.48 per ft.
512 ft. 18" 8-ply	2.00 per ft.

Rolls cut to any length.

The National Belting & Salvage Co.
268 East Water Street, Milwaukee, Wis.

FOR SALE

1—42-ton Standard gauge Baldwin Mogul, 160-lb. Steam.
1—36-ton Standard gauge Baldwin Mogul, 11′ wheel base.
2—50-ton Standard gauge Brooks 6-wheel switchers, 160-lb. steam.
1—50-ton Standard gauge Shay geared locomotive.
1—42-ton Standard gauge Shay geared locomotive.
2—23-ton brand new 36″ gauge Porter 6-wheel switchers, separate tenders.
2—18-ton O & S 8-wheel two-line locomotive cranes.
1—14-B Bucyrus Steam Shovel, mounted on traction wheels.

Birmingham Rail & Locomotive Co.
Birmingham, Ala.

No. 6 Gyratory Stone Crushers

Two Chalmers & Williams. Little used, $1550 ea. f.o.b. Rahway, N. J.

Relaying Rail and Switches in Stock

E. H. WILSON & COMPANY
Commercial Trust Building
Philadelphia

FOR SALE

1—No. 5 Austin Crusher, Direct Drive.
1—Three-Roll Bradley Pulverizer.
1—Three-yard Dirt Dipper, with reversible manganese points for 70 or 70 C Bucyrus Shovel.

This equipment is in A-1 operating condition and should be sold direct to users.

Box 1534, Care of Rock Products
542 S. Dearborn St. Chicago, Ill.

Machinery For Sale

DRYERS—Direct-heat rotary dryers, 3x25′, 3½x25′, 4x30′, 5½x50′ 6x50′ and 7x60′; double shell dryers, 4x20′, 5x30′ and 6x35′; steam-heated air rotary dryers, 4x30′ and 6x30′.

KILNS—Rotary kilns, 3½x25′, 5x60′ and 6x70′, 6x100′, 7x80′ and 8x110′.

MILLS—6x8′, 6x5′, 2½x3″ 3x3½′ pebble and ball mills; 8x4′, 6x4′ and 4x4′ continuous ball mills; 3′ March mill; 42″, 33″ and 24″ Fuller-Lehigh mills; 4½x20′, 5x11′, 5x20′, 5½x22′ and 6x20′ tube mills; 7½x13″, 9x15″, 16x10″ and 30x60″ jaw crushers; one "Infant" No. 00, No. 0, No. 2, No. 3, and No. 9 Williams' swing hammer mills; one Kent type "G" mill; 36″ and 40″ cage mills; 3′ and 4½′ Hardinge mills; 18x12″, 20x12″ and 30x10″ roll crushers; No. 0, No. 1 and No. 3 Sturtevant rotary crushers; one No. 2 Sturtevant ring roll crusher; 3 roll and No. 000, No. 00 and No. 0 Raymond mills; one No. 5 Telsmith breaker; one 36″ Sturtevant emery mill; one 3 roll Griffin mill; 60″ chaser mill.

SPECIALS—Five automatic package weighing machines; jigs; one keystone excavator; 6x8′, 6x5′ and 4x3′ Newaygo vibrating screens, Richardson automatic scales.

Air compressors and tanks.

W. P. Heineken, Engineer
95 Liberty Street, New York. Tel. Cortland 1841

FOR RENT AND SALE

13—6-yd. re-built dump cars, std. gauge.
20—12-yd. Westerns, like new, std. gauge.
50—60,000-lb. capacity flat and box cars.
1—Western standard gauge spreader.
1—Osgood 18 revolving shovel, traction wheels, No. 794, ¾-yd. bucket, used 8 mos.
1—Class 14 Bucyrus dragline on caterpillars, 70-ft. boom, 2-yd. bucket, used six months.
1—Marion 76 steam shovel, No. 3503, std. gauge.
1—P. & H. gasoline drag-line and crane, caterpillars, 40′ boom, ½-yd. bucket, new 1921.
1—Northwest gasoline drag-line and crane, caterpillars, 40′ boom, ½-yd. bucket, new 1921.
1—No. 2 Brown-Hoist four-wheel gasoline crane, std. ga., 40′ boom, ½-yd. bucket, new 1921.

LOCOMOTIVES

1—40-ton 17x24 in. four-wheel switcher.
2—NEW 25-ton six-wheel Porters, separate tenders, 36 in. gauge.
2—18, 14, and 10-ton Vulcans, 36 in. gauge.

INDUSTRIAL EQUIPMENT CO.
McCormick Building Chicago, Ill.

QUARRY EQUIPMENT

4—20 yd. Steel Underframe Side Dump Cars.
3—16 yd. Steel Underframe Western Dump Cars.
10—1½ yd. Western Dump Cars.
2—10x16 Davenport 36 in. ga. Saddle Tanks.
1—11x16 American 36 in. ga. Saddle Tank.
1—9x14 Porter 4 ft. 8½ in. ga. Saddle Tank.
1—⅝ yd. Thew "O" Traction Shovel.

Walter A. Zelnicker Supply Co., St. Louis

EQUIPMENT FOR SALE

BOILERS

1—250-H.P. Sterling.
1—300-H.P. B. & W.
2—72″x18′ H. F. T. Boilers.

ENGINES

1—24x48 Corliss.
1—18x30 Side Crank Buckeye.
1— 6x 6 Vertical.
1— 6-H.P. Fairbanks and Morse Gasoline.
1—10-H.P. Fairbanks and Morse Gasoline.

WATER HEATERS

1—30 in. x 8 ft. Pittsburg.
1—33 in. x 7 ft. 6 in. Hoppes.
1—30 in. x 7 ft. 6 in. Morrison.

WATER PUMPS

1—5x9x12½x10 in. Compound Duplex Worthington.
1—7x4½x8 Pulling.

STACKS

1—48 in. x 80 ft.

RAIL EQUIPMENT

8—36 in. gauge end dump Quarry Cars.

CRUSHERS

1—30 in. Jeffrey Swinging Hammer Pulverizer.
1—12″x20′ Screw Conveyor.

DREDGE MACHINERY

1—Set Dipper Dredge Machinery, 1½ yard Dipper, complete.

THE OHIO GRAVEL BALLAST CO.
2103 Union Central Bldg. Cincinnati, Ohio

"DREDGING PUMP" FOR SALE

One 10″ Morris Sand and Gravel dredging pump, 10″ suction, 10″ discharge, direct connected to double 9x9 engines.
One Scotch Marine Boiler, 200 H. P.

M. A. CALLAHAN
"The Sand Man"
Schofield Bldg. Cleveland, Ohio

New—RAILS—Relaying

All sections on hand for quick shipment. Reasonable prices quoted. Our stock is very complete.

M. K. FRANK
Frick Building Pittsburgh, Pa.

FOR SALE

1—Osgood No. 29 Shovel, traction wheels, 1¼ yd. dipper.
1—No. 2 Duplex Sturtevant Ring Roll Mill.
1—Jeffrey Swing Hammer Mill.
2—70 ft. Belt Conveyors, 18″ wide.

HULBERT A. BOND, Rowayton, Conn.

Classified Advertising

Rates for advertising in the Used Equipment Department: $2.50 per column inch per insertion. Minimum charge, $2.50. Please send check with your order. These ads must be paid for in advance of insertion.

For Sale, Rent or Lease

On a royalty, a modern, equipped, ground limestone crushing and pulverizing plant with 30 acres of a 30 ft. ledge of the highest testing blue limestone in Southern Ohio. No lack of business. A good local trade; plant now in operation, but am unable to manage it on account of my age and health. A fine location for a larger plant with no chance for opposition. Call on or address at once

FRANK SHARP
Lynchburg, Ohio

STONE QUARRY FOR SALE

Hardest Wisconsin Limestone, highest test as lime fertilizer (99.50%), 7 acres. Equipped stone crushing outfit. Richwood (near Watertown), side track C. M. & St. P. R. R. Excellent opportunity. Address

H. A. MARTNES, Mayville, Wis.

SUPERINTENDENT

wishes to correspond with some good crushing concern which would be interested in a man to take full charge of operation. No objection to location. Address

Box 1533, Care of Rock Products
542 South Dearborn Street, Chicago, Ill.

WANTED

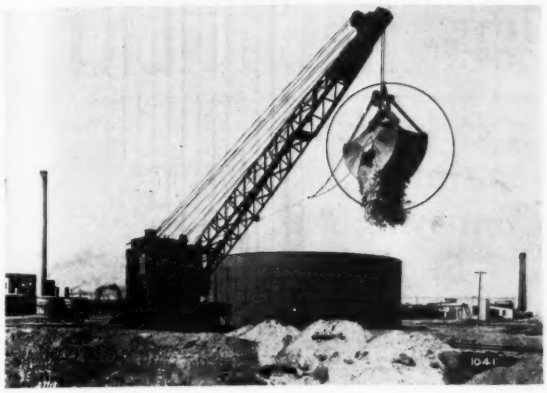
Foreman for small lime and crushing plant. Must be reliable, able to handle men and get results. Business is growing and offers good opportunity to the right man. Give full particulars with reply—age, experience, references and salary expected. Address

Box 1524, Care of Rock Products
542 South Dearborn Street Chicago, Ill.

SUPERINTENDENT

with over 15 years' experience in the construction, operation and maintenance of stone crushing and screening plants, also in the operation and maintenance of steam shovels, locomotives, drills and other modern equipment used in quarrying and excavation work, is now open for position. References furnished. Address

Box 1529, Care of Rock Products
542 South Dearborn Street Chicago, Ill.



Clam Shell Buckets at Bargain Prices

We are offering a limited number of "Type 'R' Clam Shell Buckets" in 1½ and 2 cu. yd. sizes for immediate shipment at the exceptionally low prices of—

$725.00 F. O. B. Bedford, for the 1½ cu. yd. Bucket, weighing 4250 pounds and

$850.00 F. O. B. Bedford, for the 2 cu. yd. Bucket, weighing 4975 pounds.

These buckets are of the flat link power wheel type and are of heavy substantial construction.

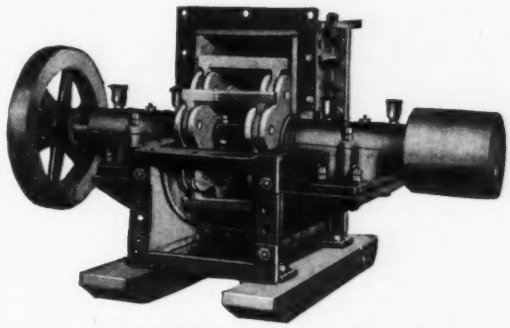
This type of bucket is especially adapted to the handling of coal, limestone, sand, gravel and other similar materials.

If you wish to purchase a superior bucket at the above prices you must act quickly.

THE McMYLER INTERSTATE CO., Cleveland, Ohio

BRANCH OFFICES

New York City, 1756 Hudson Terminal Building
Chicago, Illinois, 812 Edison Building
Seattle, Washington, Hoge Building
Denver, Colorado, 18th and Wazee Sts.
San Francisco, Calif., 766 Folsom Street
New Orleans, La., 444 Maison Blanche Annex
Birmingham, Ala., Brown-Marx Building
Boston, Mass., 261 Franklin Street



Interior of K-B Pulverizer showing Lining Plates

Does the Material You're Handling Pulverize Your Pulverizer?

All parts of the K-B Pulverizer that come in contact with the material to be crushed are made of Manganese Steel.*

Only STEEL will stand the stress
"K-B" is built ALL-Steel
All "K-B" wearing parts are Manganese Steel

Send for Catalog with full particulars

K-B Pulverizer Company, Inc.

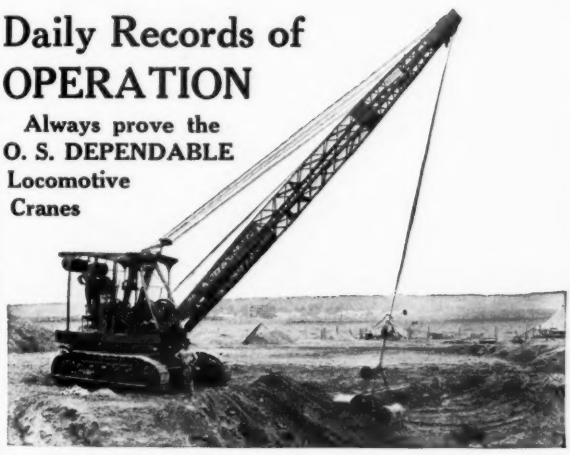
K-B PULVERIZER

92 Lafayette Street
New York

**The best material obtainable for the duty required.*

Daily Records of OPERATION

Always prove the O. S. DEPENDABLE Locomotive Cranes



The greatest money-makers wherever installed. Low maintenance cost and speed of operation obtained only by using the O. S. DEPENDABLE equipment.

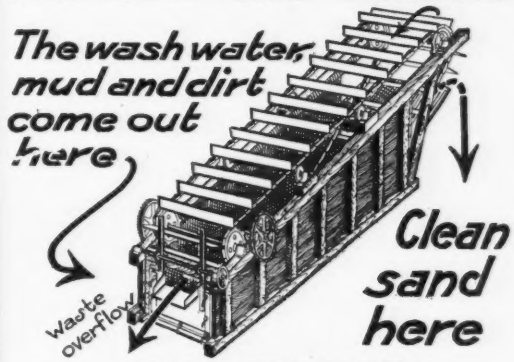
Manufactured in capacities ranging from 7 to 60 tons. Write for catalogs No. 18-21

ORTON & STEINBRENNER CO.

Main Offices—Chicago, Ill.
Factory—Huntington, Ind.

Clean Sand

Washed and Drained



THIS IS THE G-R-M DEPENDABLE

SAND SETTLING TANK

which has solved the problem of every one who has installed it. Requires very little power. No matter how dirty the sand may be, the G-R-M Sand Settling Tank will clean it.

SEND FOR INFORMATION—USE THE COUPON

GOOD ROADS MACHINERY Co. 1203 Tower Bldg., Chicago

Good Roads Machinery Co., 1203 Tower Bldg., Chicago, Ill.
Gentlemen: You may send me additional information concerning the G-R-M Sand Settling Tank.

Name_____

Address_____

We are now washing_____tons of sand per day.

Buyers' Directory
of the Rock Products Industry

Classified Directory of Advertisers in Rock Products

AERIAL TRAMWAYS

Interstate Equip. Co., New York, N. Y.

AUTOMATIC WEIGHERS

Richardson Scale Co., Passaic, N. J.
Schaffer Eng. & Equipment Co., Pittsburgh, Pa.

BAGS AND BAG MACHINERY

Bates Valve Bag Co., Chicago, Ill.
Jaite Co., The, Jaite, Ohio.
Valve Bag Co. of America, Toledo, Ohio.

BARRELS—Lime

International Cooperage Co., Niagara Falls, N. Y.
Sandusky Cooperage & Lbr. Co., Toledo, Ohio.

BELTING

Cincinnati Rubber Mfg. Co., Cincinnati, Ohio.
New York Belting & Packing Co., New York, N. Y.

BIN GATES

Allis-Chalmers Mfg. Co., Milwaukee, Wis.
Bacon, Earle C., Inc., New York City.
Link-Belt Co., Chicago, Ill.
Sturtevant Mill Co., Boston, Mass.
Traylor Eng. & Mfg. Co., Allentown, Pa.

BLASTING SUPPLIES

Atlas Powder Co., Wilmington, Del.
Du Pont de Nemours & Co., Inc., E. I., Wilmington, Del.
General Explosives Co., Chicago, Ill.
Grasselli Powder Co., Cleveland, Ohio.
Hercules Powder Co., Wilmington, Del.

BRICK MACHINERY

Besser Sales Co., Chicago, Ill.
Shope Brick Co., Portland, Ore.

BUCKETS—Elevator

Hendrick Mfg. Co., Carbondale, Pa.
Orton & Steinbrenner, Chicago, Ill.

BUCKETS

Blaw-Knox Co., Pittsburgh, Pa.
Browning Co., Cleveland, Ohio.
McMyler Interstate Co., Cleveland, Ohio.
Owen Bucket Co., Cleveland, Ohio.
Williams Co., G. H., Erie, Pa.

CABLEWAYS

Blaw-Knox Co., Pittsburgh, Pa.
S. Flory Mfg. Co., Bangor, Pa.
Interstate Equip. Co., New York, N. Y.

CALCINING MACHINERY

Atlas Car & Mfg. Co., Cleveland, Ohio.
Butterworth & Lowe, Grand Rapids, Mich.

CARS—Quarry and Industrial

Atlas Car & Mfg. Co., Cleveland, Ohio.
Easton Car & Constr. Co., Easton, Pa.
Watt Mining Car Wheel Co., Barnesville, Ohio.

CEMENT MACHINERY

Allis-Chalmers Mfg. Co., Milwaukee, Wis.

CEMENT MILL REPAIRS

Taylor-Wharton Iron & Steel Co., High Bridge, N. J.

CONVEYORS AND ELEVATORS

Caldwell, H. W., & Son Co., Chicago, Ill.
Jeffrey Mfg. Co., The, Columbus, Ohio.
Link-Belt Co., Chicago, Ill.
Smith Eng. Works, Milwaukee, Wis.
Stephens-Adamson Mfg. Co., Aurora, Ill.
Sturtevant Mill Co., Boston, Mass.
Universal Road Mach. Co., Kingston, N. Y.

CRANES—Locomotive Gantry

Ball Engine Co., Erie, Pa.
Byers Mach. Co., The, Ravenna, Ohio.
McMyler-Interstate Co., Cleveland, Ohio.
Ohio Locomotive Crane Co., Bucyrus, Ohio.
Orton & Steinbrenner, Chicago, Ill.
Osgood Co., The, Marion, Ohio.

CRUSHERS AND PULVERIZERS

Allis-Chalmers Mfg. Co., Milwaukee, Wis.
American Pulverizer Co., St. Louis, Mo.
Austin Mfg. Co., Chicago, Ill.
Bacon, Earle C., Inc., New York, N. Y.
Buchanan Co., Inc., C. G., New York, N. Y.
Butterworth & Lowe, Grand Rapids, Mich.
Chalmers & Williams, Chicago Heights, Ill.
Fuller-Lehigh Co., Fullerton, Pa.
Good Roads Machinery Co., Kennett Square, Pa.
Jeffrey Mfg. Co., The, Columbus, Ohio.
K. B. Pulverizer Co., New York, N. Y.
Kennedy-Van Saun Mfg. & Eng. Corp., New York, N. Y.
Kent Mill Co., Brooklyn, N. Y.
Lewistown Fdry. & Mach. Co., Lewistown, Pa.
McLanahan-Stone Mach. Co., Hollidaysburg, Pa.
Munson Mill Machinery Co., Utica, N. Y.
New Holland Machine Co., New Holland, Pa.
Pennsylvania Crusher Co., Philadelphia, Pa.
Raymond Bros. Impact Pulv. Co., Chicago, Ill.
Smidth & Co., F. L., New York, N. Y.
Smith Eng. Works, Milwaukee, Wis.
Sturtevant Mill Co., Boston, Mass.
Traylor Eng. & Mfg. Co., Allentown, Pa.
Universal Road Mach. Co., Kingston, N. Y.
Williams Pat. Crush. & Pulv. Co., Chicago, Ill.

CRUSHER FEEDER

Maddox Fdy. & Mchy. Co., Archer, Fla.

CRUSHER REPAIRS—Manganese Steel

American Manganese Steel Co., Chicago Heights, Ill.
Taylor-Wharton Iron & Steel Co., High Bridge, N. J.

DERRICKS

Terry Mfg. Co., New York, N. Y.

DIPPER TEETH

American Manganese Steel Co., Chicago Heights, Ill.
Taylor-Wharton Iron & Steel Co., High Bridge, N. J.

DRILLS

The Loomis Machine Co., Tiffin, Ohio.
Sanderson Cyclone Drill Co., Orrville, Ohio.
Wood Drill Works, Paterson, N. J.

DRILLERS

Pennsylvania Drilling Co., Pittsburgh, Pa.

DRYERS

American Process Co., New York City.
Vulcan Iron Works, Wilkes-Barre, Pa.

DUST COLLECTING SYSTEMS

Allis-Chalmers Mfg. Co., Milwaukee, Wis.

DYNAMITE

Atlas Powder Co., Wilmington, Del.
Du Pont de Nemours & Co., Inc., E. I., Wilmington, Del.
General Explosives Co., Chicago, Ill.
Grasselli Powder Co., Cleveland, Ohio.
Hercules Powder Co., Wilmington, Del.

ENGINES—Steam

Morris Mach. Works, Baldwinsville, N. Y.

ENGINEERS

Arnold & Weigel, Woodville, Ohio.
Austin Co., The, Cleveland, Ohio.
Bacon, Earle C., Inc., New York, N. Y.
Buckbee Co., J. C., Chicago, Ill.
Fuller Engineering Co., Allentown, Pa.
James N. Hatch, Chicago, Ill.
R. W. Hunt & Co., Chicago, Ill.
Randolph-Perkins Co., Chicago, Ill.
Smidth & Co., F. L., New York, N. Y.
Schaffer Eng. & Equip. Co., Pittsburgh, Pa.

EXCAVATORS

Ball Engine Co., Erie, Pa.
Owen Bucket Co., Cleveland, Ohio.

EXCAVATORS—Dragline Cableway

Link-Belt Co., Chicago, Ill.
Sauerman Bros., Chicago, Ill.

EXPLOSIVES

Atlas Powder Co., Wilmington, Del.
Du Pont de Nemours & Co., Inc., E. I., Wilmington, Del.
General Explosives Co., Chicago, Ill.
Grasselli Powder Co., Cleveland, Ohio.
Hercules Powder Co., Wilmington, Del.

FUSES

Ensign-Bickford Co., Simsbury, Conn.

GAS PRODUCERS

Morgan Construction Co., Worcester, Mass.

GEARS

Caldwell, H. W., & Son Co., Chicago, Ill.
Plamondon Mfg. Co., Chicago, Ill.

GLASS SAND EQUIPMENT

Lewistown Fdy. & Mach. Co., Lewistown, Pa.

GRATES

The Kramer Bros. Fdy. Co., Dayton, Ohio.

GRINDING MILLS

Munson Mill Machinery Co., Utica, N. Y.

HOISTS

Flory Mfg. Co., S., Bangor, Pa.
Thomas Elevator Co., Chicago, Ill.
Vulcan Iron Works, Wilkes-Barre, Pa.

HOSE—Water, Steam, Air Drill, Pneumatic Tool

Cincinnati Rubber Mfg. Co., Cincinnati, Ohio.
N. Y. Belting & Packing Co., New York, N. Y.

HYDRATING MACHINERY

Atlas Car & Mfg. Co., Cleveland, Ohio.
Kritzer Co., The, Chicago, Ill.
Miscampbell, H., Duluth, Minn.
Schaffer Eng. & Equip. Co., Pittsburgh, Pa.
Toepfer & Sons Co., W., Milwaukee, Wis.

HYDRAULIC DREDGES

Morris Machine Works, Baldwinsville, N. Y.

LIME KILNS

Arnold & Wiegel, Woodville, Ohio.
Glamorgan Pipe & Fdy. Co., Lynchburg, Va.
Steacy-Schmidt Mfg. Co., York, Pa.
Vulcan Iron Works, Wilkes-Barre, Pa.

LOADERS AND UNLOADERS

Ball Engine Co., Erie, Pa.
Jeffrey Mfg. Co., The, Columbus, Ohio.
Orton & Steinbrenner, Chicago, Ill.

LOCOMOTIVES

Baldwin Locomotive Works, The, Philadelphia, Pa.
Fate-Root-Heath Co., Plymouth, Ohio.
Hadfield-Penfield Steel Co., Bucyrus, Ohio.
Jeffrey Mfg. Co., The, Columbus, Ohio.
Lima Locomotive Works, New York, N. Y.
Porter Co., H. K., Pittsburgh, Pa.
Vulcan Iron Works, Wilkes-Barre, Pa.
Whitcomb Co., Geo. D., Rochelle, Ill.

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MOTOR TRUCKS
Pierce-Arrow Motor Car Co., Buffalo, N. Y.
Traylor Eng. & Mfg. Co., Allentown, Pa.

PACKING—Sheet, Piston, Superheat, Hydraulic
Cincinnati Rubber & Mfg. Co., Cincinnati, Ohio.
N. Y. Belting & Packing Co., New York, N. Y.

PAINT AND COATINGS
Williams, C. K., & Co., Easton, Pa.

PERFORATED METALS
Chicago Perforating Co., Chicago, Ill.
Cross Eng. Co., Carbondale, Pa.
Hendrick Mfg. Co., Carbondale, Pa.

PIPE JOINTS
Berry Flexible Pipe Joint Co., Philadelphia, Pa.

PLASTER MACHINERY
Butterworth & Lowe, Grand Rapids, Mich.
Ehrsam & Sons Co., J. B., Enterprise, Kans.

PORTABLE CONVEYORS
Stephens-Adamson Mfg. Co., Aurora, Ill.

POWDER
Atlas Powder Co., Wilmington, Del.
Du Pont de Nemours & Co., Inc., E. I., Wilmington, Del.
General Explosives Co., Chicago, Ill.
Grasselli Powder Co., Cleveland, Ohio.
Hercules Powder Co., Wilmington, Del.

POWER TRANSMITTING MACHINERY
Caldwell, H. W., & Son Co., Chicago, Ill.

PUMPS
Allis-Chalmers Mfg. Co., Milwaukee, Wis.
American Manganese Steel Co., Chicago Heights, Ill.
K. C. Hay Press & Tractor Co., Kansas City, Mo.
Morris Machine Works, Baldwinsville, N. Y.

PULVERIZED FUEL EQUIPMENT
Fuller-Lehigh Co., Fullerton, Pa.
Raymond Bros. Impact Pulv. Co., Chicago, Ill.

PUMP VALVES
N. Y. Belting & Packing Co., New York, N. Y.

QUARRY EQUIPMENT
Universal Road Mach. Co., Kingston, N. Y.

ROPE, WIRE
American Steel & Wire Co., Chicago, Ill.
Leschen, A., & Sons Co., St. Louis, Mo.

SAFETY DEVICES—Goggles, Respirators, Etc.
Pulmosan Safety Equipment Co., Brooklyn, N. Y.

SCALES
Richardson Scale Co., Passaic, N. J.

SCRAPERS, DRAG
Sauerman Bros., Chicago, Ill.

SCREENS
Cross Eng. Co., Carbondale, Pa.
Good Roads Machinery Co., Kennett Square, Pa.
Hendrick Mfg. Co., Carbondale, Pa.
Jeffrey Mfg. Co., The, Columbus, Ohio.
Link-Belt Co., Chicago, Ill.
Simplex Screen Co., Salt Lake City, Utah.
Smith Eng. Works, Milwaukee, Wis.
Stephens-Adamson Mfg. Co., Aurora, Ill.
Stimpson Equip. Co., Salt Lake City, Utah.
Sturtevant Mill Co., Boston, Mass.
Tyler Co., The, W. S., Cleveland, Ohio.
Universal Road Mach. Co., Kingston, N. Y.

SEPARATORS
Rubert M. Gay Co., New York City.
Raymond Bros. Impact Pulv. Co., Chicago, Ill.
Sturtevant Mill Co., Boston, Mass.
Tyler Co., The W. S., Cleveland, Ohio.

SEPARATORS, MAGNETIC
Buchanan Co., C. G., Inc., New York, N. Y.

SHEAVES
Chicago Mining Sheave & Roller Co., Chicago, Ill.

SHOVELS—Steam and Electric
Ball Engine Co., Erie, Pa.
Bucyrus Co., South Milwaukee, Wis.
Orton & Steinbrenner Co., Chicago, Ill.
Osgood Co., The, Marion, Ohio.

SHOVEL REPAIRS—Steam and Electric
Taylor-Wharton Iron & Steel Co., High Bridge, N. J.

SHOVELING MACHINES
Myers-Whaley Co., Knoxville, Tenn.

SLATE WORKING MACHINERY
S. Flory Mfg. Co., Bangor, Pa.

STEEL PLATE CONSTRUCTION
Hendrick Mfg. Co., Carbondale, Pa.

STUCCO FACINGS
Crown Point Spar Co., Inc., New York City.
Greenstone Products Co., Roanoke, Va.
The Metro-Nite Co., Milwaukee, Wis.

SWITCHES AND FROGS
Central Frog & Switch Co., Cincinnati, Ohio.
Easton Car & Constr. Co., Easton, Pa.

TANKS, STEEL STORAGE
The Blaw-Knox Co., Pittsburgh, Pa.
Pittsburgh-Des Moines Steel Co., Pittsburgh, Pa.
The Stacey Bros. Gas Constr. Co., Cincinnati, Ohio.

TESTING SIEVES AND TESTING SIEVE SHAKERS
Tyler Co., The W. S., Cleveland, Ohio.

TRAMWAYS
Interstate Equip. Co., New York, N. Y.

WASHERS, SAND AND GRAVEL
Link Belt Co., Chicago, Ill.
Smith Eng. Works, Milwaukee, Wis.

WELDING EQUIPMENT
Oxweld Acetylene Co., Newark, N. J.

WHEELS, AXLES AND JOURNAL BOXES
Easton Car & Constr. Co., Easton, Pa.

WIRE ROPE
American Steel & Wire Co., Chicago, Ill.
Leschen, A., & Sons Co., St. Louis, Mo.

WIRE CLOTH
Cleveland Wire Cloth Co., Cleveland, Ohio.
Tyler Co., The W. S., Cleveland, Ohio.

Buyers' Bulletin

MANUFACTURERS OF MACHINERY AND EQUIPMENT:—These inquiries are live, up-to-date inquiries that have come direct to us from the individual in each case.

READERS OF "ROCK PRODUCTS":—This Department is for your special help and service. If you do not see what you require advertised in "Rock Products," tell us your needs and we will publish them here. There is no charge for this service.

C. W. Young, Sand and Gravel Producer, Tuckahoe, N. J., wants catalogs of screens and small paint machinery.

The Rampus Stone Co., Strawberry Plains, Tenn., are in the market for a jaw crusher with 48x60-inch opening.

The G. R. Mueller Co., Birmingham, Ala., are in the market for a No. 5 or No. 7½ gyratory crusher for crushing limestone.

John T. Hammond, New Smyrna, Florida, wants catalogs, prices, etc., on light gasoline caterpillars with revolving boom.

Mazer Acoustile Co., 1209 Arch St., Philadelphia, Pa., want literature and prices on mixing mill for the making and bagging of plaster manufactured from calcined gypsum. Also want to hear from manufacturers of lime and other retarders used in the making of wall plaster.

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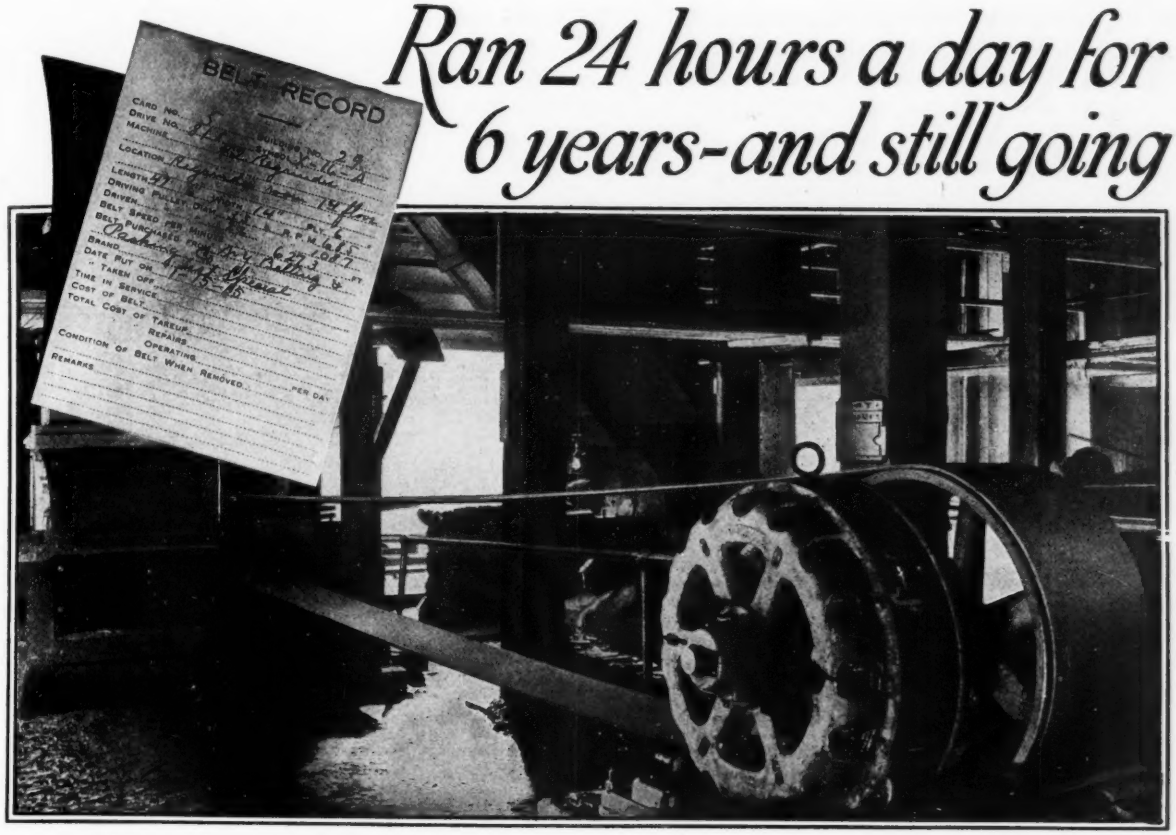
Ran 24 hours a day for 6 years-and still going



The photograph shows a TEST SPECIAL Rubber Belt on Regrinding Machine at the mill of Champion Fibre Co., Canton, N. C.

DELIVERING power at more than a mile a minute belt speed for six years is the remarkable record of this TEST SPECIAL Rubber Belt. Notwithstanding the severe duty of working 24 hours a day at such an excessive rate, the belt is in excellent condition and good for many years' service.

In countless other places TEST SPECIAL Rubber Belting is daily proving its sterling qualities of build. In the great Lumber Mills of the South and Northwest, the Paper Mills, Mines, Steel Mills, in fact industry everywhere is coming to know that full reliance can be placed on TEST SPECIAL Rubber Belting.

These features are worthy of your careful consideration:

—great strength and endurance are combined in TEST SPECIAL Rubber Belting.
—stretch is practically eliminated.
—by the nature of the materials used in the construction of TEST SPECIAL Rubber Belting, cotton duck and rubber, it is thoroughly waterproof, naturally non-slipping and flexible.

Test Special Rubber Belting Will Make Records for You

NEW YORK BELTING & PACKING CO.

New York
Boston
Chicago
Philadelphia
Pittsburgh
St. Louis
Salt Lake City
San Francisco

TEST SPECIAL RUBBER BELTING

STRENGTH — SERVICE — ECONOMY